MONTANA DEPARTMENT OF TRANSPORTATION
WETLAND MITIGATION MONITORING REPORT: YEAR 2009

Little Muddy Creek
Cascade County, Montana



Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Ave
Helena, MT 59620-1001

Prepared by:

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820 North Montana Avenue, Suite A
Helena, MT 59601

December 2009

PBS&J Project No: 0B4308802.04.03

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 METHODS 3

Monitoring Dates and Activities 3

2.1 Hydrology 3

2.2 Vegetation 3

2.3 Soils 4

2.4 Wetland Delineation 4

2.5 Fish and Wildlife 4

2.6 Birds 4

2.7 Macroinvertebrates 5

2.8 Functional Assessment 5

2.9 Photographs 5

2.10 GPS Data 5

2.11 Maintenance Needs 5

3.0 RESULTS 6

Hydrology 6

3.1 Vegetation 6

3.2 Soils 11

3.3 Wetland Delineation 12

3.4 Fish and Wildlife 12

3.5 Macroinvertebrates 13

3.6 Functional Assessment 14

3.7 Photographs 15

3.8 Maintenance Needs/Recommendations 16

3.9 Current Credit Summary 16

4.0 REFERENCES 17

TABLES

Table 1 *Vegetation species observed from 2004 to 2009 at the Little Muddy Creek Wetland Mitigation Site.*

Table 2 *Data summary for Transect 1 at the Little Muddy Wetland Mitigation Site.*

Table 3 *Data summary for Transect 2 at the Little Muddy Wetland Mitigation Site.*

Table 4 *Acreages for each wetland community from 2007 through 2009 at the Little Muddy Creek Wetland Mitigation Site.*

Table 5 *Fish and wildlife species observed within the Little Muddy Creek Wetland Mitigation Site in 2004 to 2009.*

Table 6 *Summary of 2006 through 2009 wetland function/value ratings and functional points at the Little Muddy Creek Wetland Mitigation Site.*

FIGURES

Figure 1 *Project Site Location Map*

Figure 2 *2009 Monitoring Activity Locations*

Figure 3 *2009 Mapped Site Features*

CHARTS

Chart 1 *Transect maps showing vegetation types of Transect 1 from start (0 feet) to end (585 feet) from 2004 to 2009.*

Chart 2 *Length of* vegetation communities within *Transect 1 during 2004 to 2009.*

Chart 3 *Transect maps showing vegetation types of Transect 2 from start (0 feet) to end (310 feet) from 2004 to 2009.*

Chart 4 *Length of* vegetation communities within *Transect 2 during 2004 to 2009.*

Chart 5 *Bioassessment scores using the wetland index at the Little Muddy Creek Wetland Mitigation Site from 2007 to 2009.*

APPENDICES

Appendix A *Figures 2 & 3*

Appendix B *2009 Wetland Mitigation Site Monitoring Form*
2009 Bird Survey Form
2009 COE Wetland Delineation Forms'
2009 MDT Wetland Mitigation Site Monitoring Form

Appendix C *2009 Representative Photographs*

Appendix D *Project Plan Sheet*

Appendix E *Bird Survey Protocol*
GPS Protocol

Appendix F *2009 Macroinvertebrate Sampling Protocol and Data Analysis*

1.0 INTRODUCTION

The Little Muddy Creek wetland mitigation project was constructed in 2004 by Ducks Unlimited and the property owner. The purpose of the project is to create wetland habitat for migratory birds and to serve as a wetland mitigation reserve for the Montana Department of Transportation (MDT). It was originally anticipated by MDT that approximately 13.57 acres of compensatory wetland mitigation credit could be needed to offset impacts associated with ten different projects within the Missouri-Sun-Smith River watershed (#7) (MDT 2002). An additional 50 acres of reserve credit was also sought by MDT (MDT 2002). Thus, MDT originally sought 63.57 acres of compensatory wetland mitigation credit.

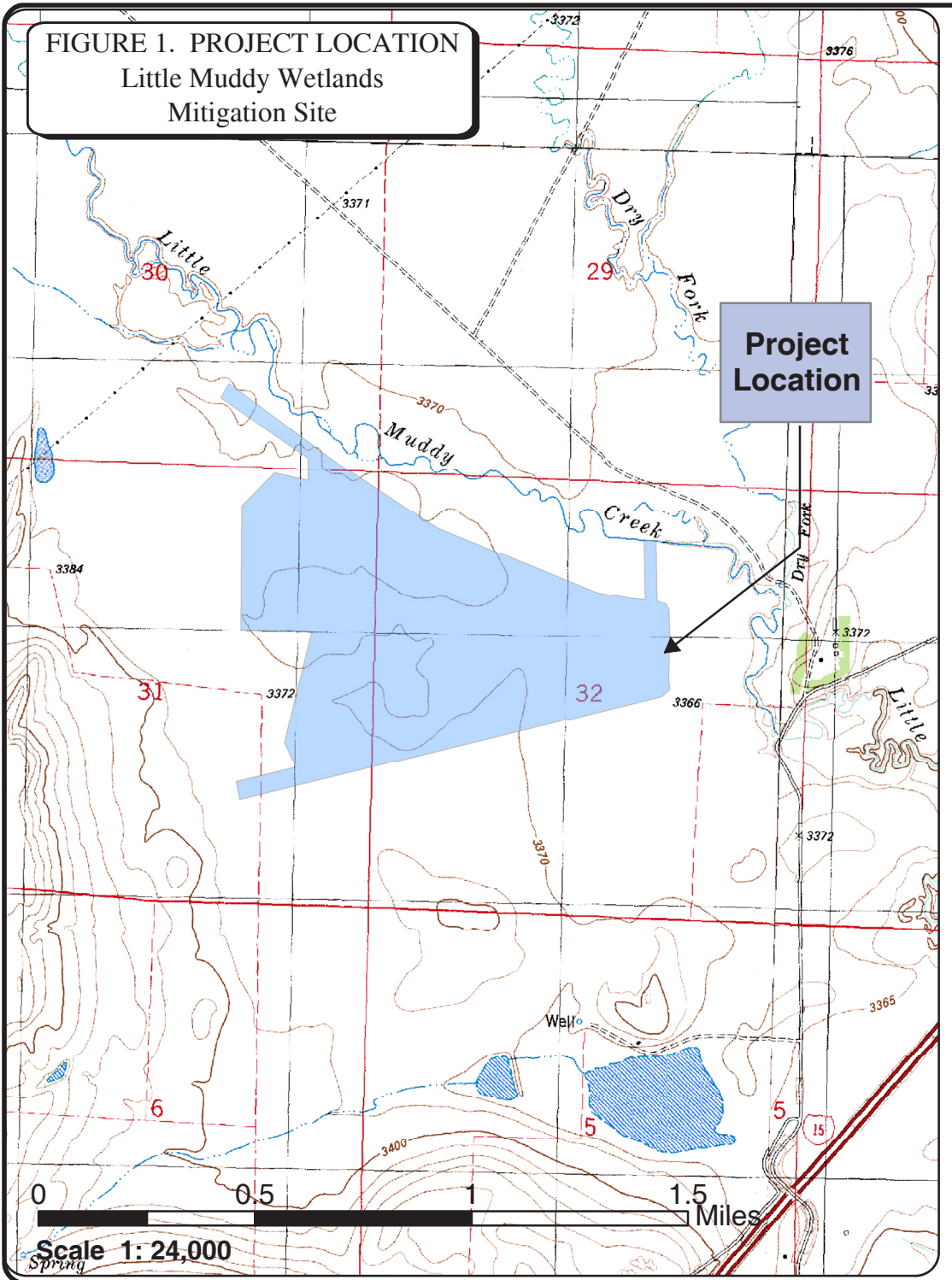
This report documents the sixth year of monitoring at the Little Muddy Creek Wetland Mitigation site. This project is located on private land, approximately one mile west of Interstate 15 between the towns of Cascade and Ulm, Montana (**Figure 1**). The project site straddles Sections 30, 31, and 32 of Township 19 North and Range 1 East in Cascade County.

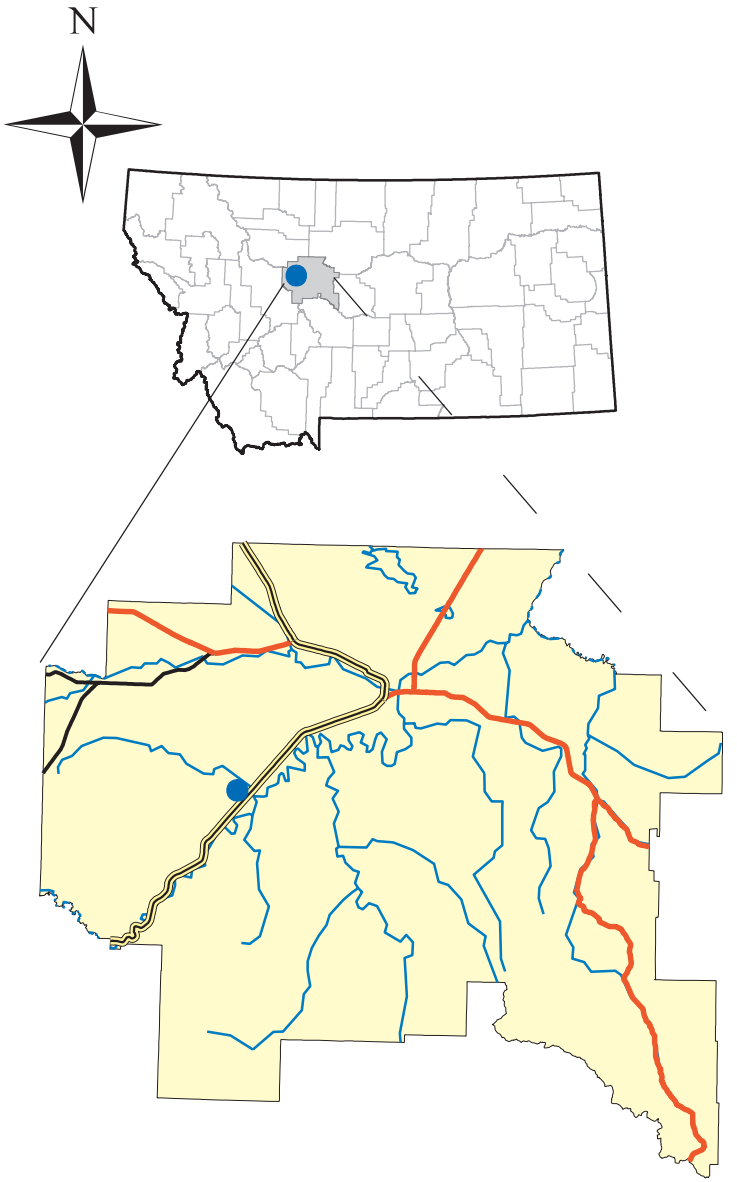
Little Muddy Creek is an intermittent stream that flows directly into the Missouri River (COE 2002). In 2004, an 88 foot-wide diversion dam was built across the entire Little Muddy Creek channel (COE 2002). The central 30 feet of the dam is elevated three feet above the existing channel bottom and the ends of the dam rise up to meet the adjacent stream banks. Water is impounded in the channel of Little Muddy Creek for a distance upstream of 2,700 feet. An inlet channel of approximately 400 feet was excavated from the point of diversion to an inlet water control structure with a headgate. When the headgate is open, water flows through a long, excavated channel to the off-channel impoundment. The off-channel impoundment is surrounded by an 11,500-foot long berm. A project plan sheet is provided in **Appendix D**.

At the full pool elevation, the off-channel impoundment is anticipated to have a surface area of about 216 acres, a depth of five feet, and a maximum water storage volume of 387 acre-feet. To create this wetland, a maximum of 35 cubic feet per second (cfs) of water can be diverted during spring flows (COE 2002). When Little Muddy Creek is flowing, a minimum of 1 cfs must remain in the channel below the point of diversion. Upon filling the site, all streamflow continues downstream. No diversion of water is allowed after June 30th of each year. Further, no diversion is allowed when the combined flows of the Missouri River near Ulm and the Sun River near Vaughn total less than 7,880 cfs.

Prior to project implementation, no wetland habitat existed within the main project site. However, three emergent wetlands did occur in association with Little Muddy Creek near the proposed project structures and a narrow wetland fringe occurred along most of Little Muddy Creek (LWC 2002). Target wetland communities to be produced at the site included open water/aquatic bed and shallow marsh/wet meadow.

FIGURE 1. PROJECT LOCATION
Little Muddy Wetlands
Mitigation Site





PROJECT #: N .N 2N
DATE: FEB 2N
LOCATION: N
PROJECT MANAGER A. PIPPN
DRAWN BY L. LUNDQUISTN

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2.0 METHODS

2.1 Monitoring Dates and Activities

The site was visited on June 1st (spring bird survey) and August 3rd (mid-season survey) of 2009. All information contained on the Wetland Mitigation Site Monitoring Form was collected during these two site visits (**Appendix B**). Monitoring activity locations are illustrated on **Figure 2** in **Appendix A**. Activities conducted and information collected included: wetland delineation; vegetation community mapping; vegetation transect monitoring; soils data collection; hydrology data collection; bird and wildlife use documentation; macroinvertebrate sampling; photographing; and cursory examination of the dike and water control structures.

2.2 Hydrology

Hydrologic indicators were evaluated during the mid-season visit on August 3rd. Wetland hydrology indicators were recorded using procedures outlined in the COE 1987 Wetland Delineation Manual (Environmental Laboratory 1987). Hydrology data were recorded on COE Routine Wetland Delineation Data Forms and on the Wetland Mitigation Site Monitoring Form (**Appendix B**).

There are no groundwater monitoring wells at the site. Soil pits excavated for wetland delineation purposes were also used to evaluate the presence of groundwater if occurring within 12 inches from the ground surface. Data were recorded on the COE Routine Wetland Delineation Data Form (**Appendix B**).

2.3 Vegetation

General dominant species-based vegetation community types were delineated in the field during the spring and mid-summer field visits. Standardized community mapping was not employed as many of these systems are geared towards climax vegetation. Estimated percent cover of the dominant species in each community type was recorded on the Wetland Mitigation Site Monitoring Form (**Appendix B**). Plants observed were identified using *Flora of the Pacific Northwest* (Hitchcock and Conquist 1975) and *Plants of Montana* (Dorn 1984). Nomenclature follows that of Dorn (1984). In addition, a few plant specimens were sent to the Montana State University Herbarium for species verification.

Annual changes in vegetation, especially the establishment and increase of hydrophytic plants, were evaluated through the use of belt transects. Two vegetation belt transects of approximately 300 feet long by 10 feet wide and 600 feet long by 10 feet wide were established in early June of 2004; these transects were shortened to about 200 and 300 feet, respectively, in 2005-2008 (**Figure 2** in **Appendix A)**. The transect start and end points were staked in the ground and recorded with a GPS unit in 2004. Percent cover was estimated for each successive vegetative species encountered within the "belt" using the following values: + (<1%); 1 (1-5%); 2 (6-10%); 3 (11-20%); 4 (21-50%); and 5 (>50%). Photographs were taken at the start and end of each transect (if possible) during the mid-season visit (**Appendix C**). No woody species were planted at the site. Consequently, no monitoring of such species was conducted.

2.4 Soils

Soil information was obtained from the Soil Survey for Cascade County. Soils were evaluated during the mid-season visit according to procedures outlined in the COE 1987 Wetland Delineation Manual. In the field, surface soils were evaluated for signs of wetland formation during the mid-season visit. If wetland indicators for hydrology or plants were found then a soil pit was excavated to look for evidence of hydric soil formation. Soil data were then recorded on the COE Routine Wetland Delineation Form (**Appendix B**).

2.5 Wetland Delineation

A wetland delineation was conducted during the mid-season visit according the 1987 COE Wetland Delineation Manual. In July 2008, consultation with the COE (Steinle pers. comm.) confirmed that, where the 1987 manual was used to establish baseline wetland conditions at MDT wetland mitigation sites, it should continue to be applied at such sites for the duration of the monitoring period. Consequently, application of the new *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (COE 2008) was not required or undertaken at this site in 2008 or 2009.

The monitoring area was investigated for the presence of wetland hydrology, hydrophytic vegetation, and hydric soils. The indicator status of vegetation was derived from the National List of Plant Species that Occur in Wetlands: Northwest Region 9 (Reed 1988). The information was recorded on a COE Routine Wetland Delineation Data Form (**Appendix B**). Wetland communities were mapped using a combination of a resource grade GPS unit and hand-mapping onto the 2008 / 2009 aerial photographs.

2.6 Fish and Wildlife

Mammal, reptile, and amphibian species observations and other positive indicators of use, such as vocalizations, were recorded on the wetland monitoring form during the site visits. Indirect use indicators, including tracks, scat, burrow, eggshells, skins, and bones, were also recorded. These signs were recorded as the observer traversed the site while conducting other required activities. Direct sampling methods, such as snap traps, live traps, and pitfall traps, were not used. A comprehensive wildlife species list for the entire site was compiled (**Appendix B**).

2.7 Birds

Bird observations were recorded during the site visits. No formal census plots, spot mapping, point counts, or strip transects were conducted. Bird observations were recorded incidental to other monitoring activity observations, using the bird survey protocol as a general guideline (**Appendix E**). Observations were categorized by species, activity code, and general habitat association (**Bird Survey Field Data Sheet** in **Appendix B**). A comprehensive bird list was compiled using these observations.

2.8 Macroinvertebrates

Per MDT instructions, aquatic macroinvertebrates were sampled in 2007 and 2008. One macroinvertebrate sample was collected during the mid-season visit. The location was mapped onto the 2009 aerial photograph with use of a global positioning system (GPS) unit. The sample was collected and preserved according to the Macroinvertebrate Sampling Protocol (**Appendix F**). Laboratory analysis of the sample and reporting were conducted by Rhithron Associates, Inc. in Missoula, Montana.

2.9 Functional Assessment

From 2004 through 2007 functional assessments were completed using the 1999 MDT Montana Wetland Assessment Method (Berglund 1999). In 2008 through 2009 the 2008 MDT Montana Wetland Assessment Method (Berglund and McEldowney 2008) was applied. Field data necessary for this assessment were primarily collected during the mid-season site visit. The remainder of the functional assessment was completed in the office. For each wetland or group of wetlands a Functional Assessment Form was completed (**Appendix B**).

2.10 Photographs

Photographs were taken in 2009 to show the current land use surrounding the site, the upland buffer, the monitored area, and the vegetation transects (**Appendix C**). Six photograph points were established and their location recorded with a resource grade GPS unit from 2004 to 2009. Photographs have been taken at these six photo points each year since in 2004. A description and compass direction for each photograph was recorded onto the Wetland Mitigation Site Monitoring Form (**Appendix B**).

2.11 GPS Data

During the 2004 monitoring season, survey points were collected with a resource grade GPS unit at vegetation transect beginning and ending locations (**Appendix E**). The GPS point and survey data from Ducks Unlimited were used to rectify MDT aerial photographs taken during the 2006 flight. Mapping of site features in 2009 included both GPS data collection and hand-mapping onto the 2008 / 2009 aerial photographs.

2.12 Maintenance Needs

The diversion, excavated channels, and 11,500-foot long berm were built in winter of 2003. The berm was seeded with an upland plant mix. These were examined during the 2009 site visits for obvious signs of breaching, damage, or other problems. This did not constitute an engineering-level structural inspection, but rather a cursory examination.

3.0 RESULTS

3.1 Hydrology

In 2004, combined flows in the Missouri River at Ulm and the Sun River at Vaughn did not exceed 7,880 cfs by June 30th, and no water was allowed to flow into the site. In 2005, enough precipitation occurred in May that the most of the mitigation site was inundated. In 2006, the site was topped off from streamflow and precipitation and it held water through the growing season. In 2007, streamflow was sufficient, but the site was only partially filled because water was turned off by an unauthorized party without permission (Durocher pers. comm.). In 2007 the site was over a foot short of its full pool capacity (Durocher pers. comm.). In addition it was discovered that the outlet was plugged and prevented water from flowing properly through the site; this problem has since been fixed (Durocher pers. comm.). In 2008 stream flows were sufficient that the site filled to its capacity and by early August the site was only about six inches below the full-pool level (Durocher pers. comm.). In 2009 heavy snow- and rain-fall created very high water in Little Muddy Creek. Water was overtopping a concrete bridge located northwest of the project area. An abundance of spring precipitation combined with heavy rainfall in early August kept the site full throughout the growing season in 2009. Depth of inundation ranged from an inch to about three feet in the main project impoundment. Depth of the deepest portion of the inlet channel was approximately eight feet.

It was assumed that precipitation levels measured at the Great Falls Airport weather station (#243751) would serve as an indicator of precipitation received at the mitigation site. From January to August of 2009, the Great Falls Airport weather station reported 11.02 inches (in) of annual precipitation (Western Regional Climate Center [WRCC] 2009). This represents 95% of the mean precipitation (11.55 inches) received between January and August from 1948 to 2009. The January through August period in 2009 was wetter than the same timeframe in 2008 (9.51 in), 2007 (8.59 in), and 2004 (10.34 in), but drier than this timeframe in 2006 (14.21 in) and 2005 (11.30 in) (WRCC 2009).

3.2 Vegetation

Historical aerial photographs showed that the native vegetation of mixed grass- and shrub-land was converted into cropland sometime between 1937 and 1950 (LWC 2002). Since conversion, the project site has been used for dryland farming (domestic barley and wheat) and possibly for occasional grazing (LWC 2002). Prior to 2003, grazing was terminated and the land was planted with native grass and crop species and placed into the Conservation Reserve Program (LWC 2002).

Since 2004 a comprehensive plant species list has been maintained for the Little Muddy Creek Wetland Mitigation Site (**Table 1**; **Monitoring Form** in **Appendix B**). In 2004, the mitigation site was comprised of upland grasses and forbs and did not flood. By July 2005 most of the upland vegetation was flooded and had drowned, but wetland vegetation had not established. By August 2006, wetland vegetation had germinated over most of the saturated soils and aquatic plants had colonized inundated areas. Since 2007, wetland vegetation has established, creating

emergent and aquatic bed communities. The community boundaries change each year with the timing and duration of water.

Table 1: ***Vegetation species observed from 2004 to 2009 at the Little Muddy Creek Wetland Mitigation Site.***

Scientific Name	Region 9 (Northwest) Wetland Indicator	Scientific Name	Region 9 (Northwest) Wetland Indicator
Agropyron cristatum	---	*Lactuca serriola*	FAC-
Agropyron smithii	FACU	*Medicago sativa*	---
algae, green	---	*Melilotus alba*	---
Alisma gramineum	OBL	*Melilotus officinale*	FACU
Alopecurus arundinaceus	NI	*Polygonum aviculare*	FACW-
Arctium minus	---	*Polygonum douglasii*	FACU
Artemisia frigida	---	*Populus tremuloides*	FAC+
Aster pansus	FAC+	*Potamogeton* (*amplifolius*)	OBL
Atriplex rosea (*A. argentea*)	FACU- (FAC-)	*Potamogeton pectinatus*	OBL
Bromus inermis	---	*Ranunculus cymbalaria*	OBL
Bromus japonicus	---	*Rorippa sinuata*	FAC+
Cardaria pubescens	---	*Rosa* spp.	---
Chenopodium album	FAC	*Rumex crispus*	FACW
Chenopodium glaucum	FAC	*Rumex maritimus*	FACW+
Chenopodium leptophyllum	FACU	*Salix exigua*	OBL
***Chenopodium* (*rubrum*)**	**(FACW+)**	*Salix lutea*	OBL
Chenopodium spp.	---	*Salsola iberica* (syn. *S. kali*)	FACU
Cirsium arvense	FACU+	*Scirpus acutus*	OBL
Eleocharis palustris	OBL	*Scirpus* (*maritimus*)	(OBL)
Elymus hispidus (syn. *Agropyron intermedium*)	---	*Scirpus pungens*	OBL
Elymus varnensis	---	*Sisymbrium altissimum*	FACU-
Grindelia squarrosa	FACU	*Sisymbrium* spp.	---
Helianthus annuus	FACU+	*Sonchus arvensis*	FACU+
Hordeum jubatum	FAC+	*Thlaspi arvense*	NI
Iva axillaris	FAC	*Tragopogon dubois*	---
Kochia scoparia	FAC	*Typha latifolia*	OBL

Bolded species were observed for the first time in 2009.

Vegetation community types were based on topography, hydrology, and plant composition. Seven wetland communities were delineated. Type 7 – *Rumex maritimus* wetland community continued to expand in width as a fringe along the inlet channel, except in the northeast portion of the project area (**Photos 7, 13-15,** and **27-30** in **Appendix C**). The Type 8 – Algae / Aquatic Plant wetland community expanded in 2009 in response to high water (**Photos 4, 7,** and **22** in **Appendix C**). The Type 8 community of 2006 is considered the same as in 2009; however, the name was changed from *Potamogeton* / *Polygonum* to Algae / Aquatic Plant wetland. In 2009 algae continued to be the dominating organism while *Polygonum aviculare* occupied only small patches on the peninsula. The Aquatic Plant component, *Potamogeton* and *Alisma*, continued to increase in abundance and distribution. The Type 9 – *Polygonum aviculare* community occupied saturated land where the water had receded. In 2009 this community was greatly reduced and consisted of small, but discrete patches of *Polygonum aviculare*, *Hordeum jubatum*, and *Typha latifolia* (**Photos 16-17** in **Appendix C**).

The Type 10 – *Typha latifolia* community increased in size in response to a larger area of saturated or inundated soil (**Cover Photo; Photo 19** in **Appendix C**). The Type 11 – *Hordeum jubatum* wetland decreased in size and only occupied land where water had receded (**Photo 18** in **Appendix C**). As in previous years, the Type 12 – *Alisma gramineum* wetland occupied the outlet. *Alisma gramineum* plants were mixed with a variety of wetland plants such as, *Eleocharis*, *Typha*, and *Scirpus* species (**Photo 12** in **Appendix C**). The Type 14 – *Rumex*/*Eleocharis* community occupied inundated soil (**Photos 21** and **24** in **Appendix C**). Within Type 14, *Rumex maritimus dominated while Eleocharis palustris* and *Rumex crispus* were sparse. The boundary between Types 11 and 14 were hazy; *Hordeum jubatum* grew densest where water had receded and *Rumex*/*Eleocharis* grew densest where water inundated the soil.

Types 6 and 13 were upland habitats that colonized the berm and the western boundary of the project area (**Photo 20** in **Appendix C**). In 2009 soils along the western boundary were saturated or inundated, but maintained an abundance of upland grasses. In 2009 the area of *Transitional Open Water* decreased. It has been characterized by inundated soils (one inch to eight feet) with algae, but no visible vascular plants (**Photos 1-2** in **Appendix C**).

The changes in plant composition and hydrology from 2004 to 2009 were quantified on the T-1 Vegetation Transects 1 (**Table 2**). The 2009 condition at T-1 was documented with a photograph (**Photos 10** in **Appendix C**). Along T-1, upland habitat found in 2004 was inundated in 2005 (**Table 2** and **Chart 1**). By 2006 all except the upland berm had transitioned into mudflat, open water, or wetland (**Chart 1**). The number of upland and wetland communities remained the same from 2007 to 2008; however, the percentage of transect occupied by wetland increased in 2008 (**Table 2** and **Chart 1**). Mudflat and Transitional Open Water found in 2007 became Type 8 wetland in 2008 (**Chart 1**). Conditions along Transect 1 in 2009 were nearly identical to those in 2008 (**Table 2** and **Chart 1).** Since 2004, the general trend has shown that wetland habitat has increased while upland and open water have decreased (**Chart 2**).

Table 2: ***Data summary for Transect 1 at the Little Muddy Wetland Mitigation Site.***

Monitoring Year	2004	2005[1]	2006	2007	2008	2009
Transect Length (feet)	585	585	585	585	585	585
# Vegetation Community Transitions along Transect	2	0	3	2	2	2
# Vegetation Communities along Transect	3	0	2	3	3	3
# Hydrophytic Vegetation Communities along Transect	0	0	1	2	2	2
Total Vegetative Species	11	1	7	9	8	10
Total Hydrophytic Species	2	1	4	4	4	7
Total Upland Species	9	0	3	5	4	3
Estimated % Total Vegetative Cover[2]	90	8	60	85	85	73
% Transect Length Comprised of Hydrophytic Vegetation Communities	0	0	92	32	98	98
% Transect Length Comprised of Upland Vegetation Communities	100	0	1	2	2	2
% Transect Length Comprised of Unvegetated Open Water	0	100	5	34	0	0
% Transect Length Comprised of Bare Substrate	0	0	2	32	0	0

[1] Transect 1 consisted of only open water with scattered *Hordeum jubatum* plants that did not constitute a vegetation community and may have been in the process of dying due to flooding.

[2] In years when algae is present, its cover is included in the percentage.

Chart 1: ***Transect maps showing vegetation types of Transect 1 from start (0 feet) to end (585 feet) from 2004 to 2009.***

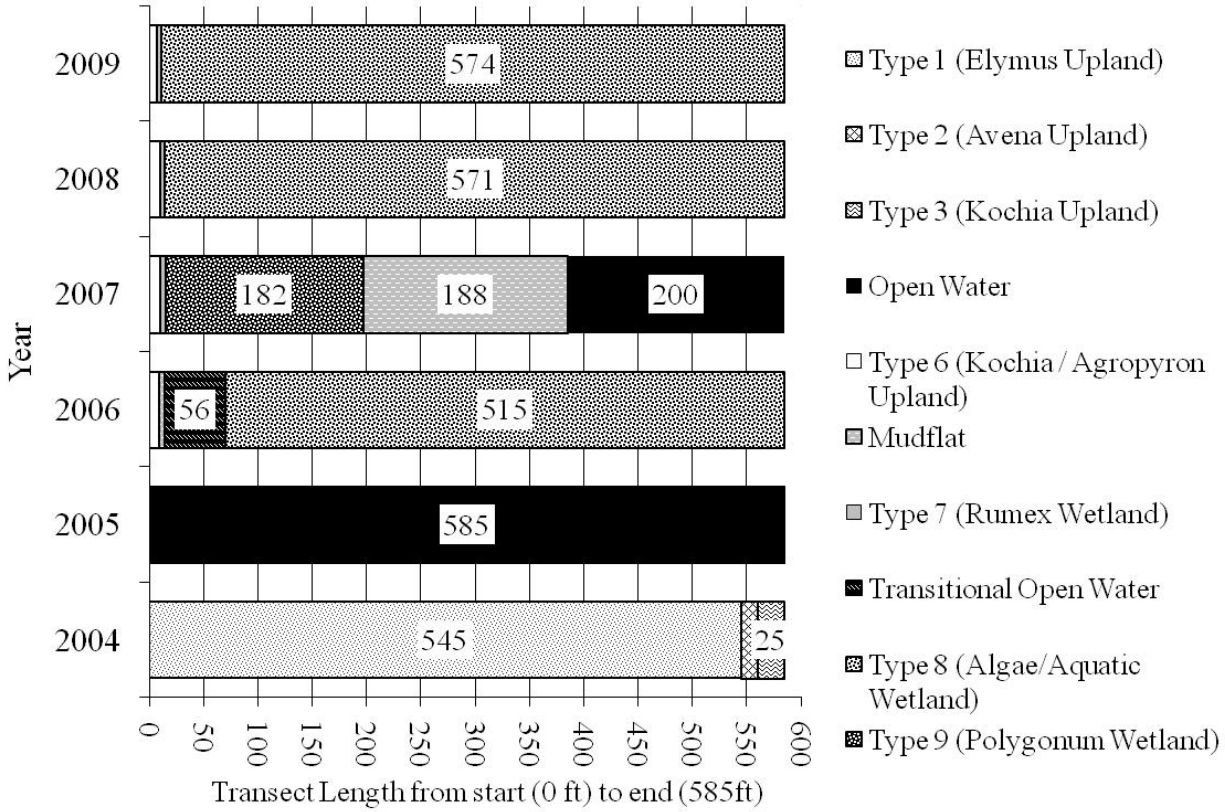
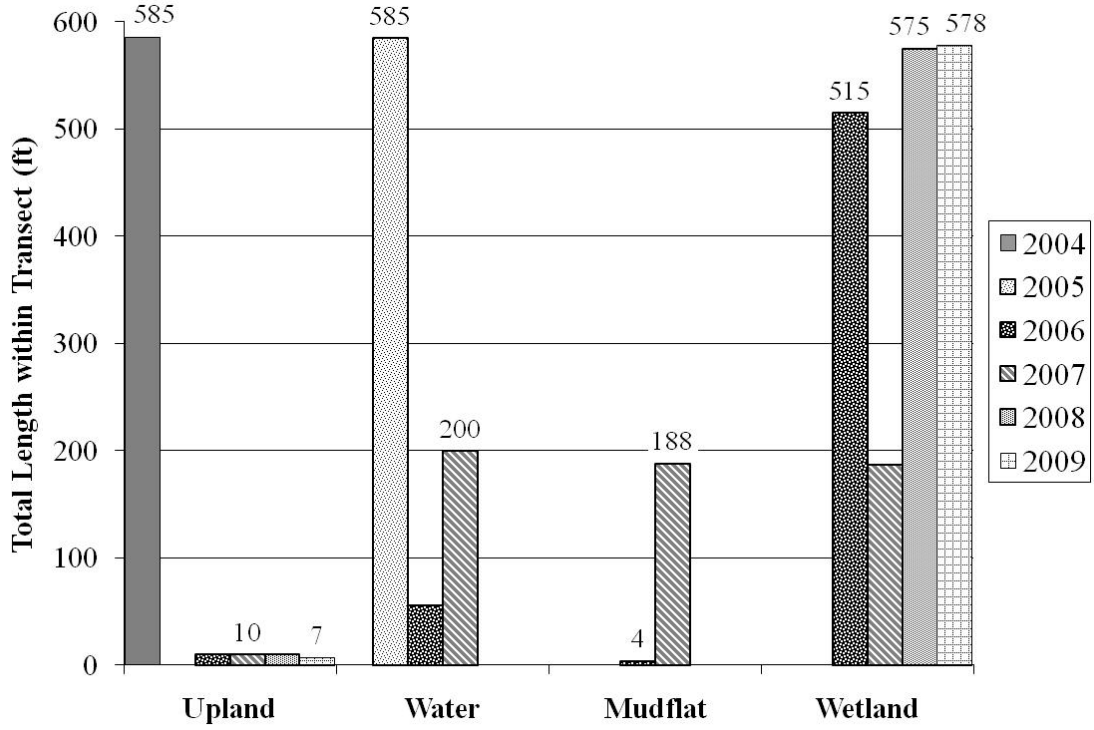


Chart 2: ***Length of vegetation communities within Transect 1 from 2004 to 2009.***



Similar trends of wetland development found at T-1 have occurred at T-2. The 2009 condition was documented with a photograph of T-2 (**Photos 11** in **Appendix C**). Upland communities have transitioned to wetland communities since 2004 (**Table 3**). The 2004 upland habitat was inundated in 2005 and by 2007 had slightly transitioned into wetland (**Chart 3**). The Type 7 – *Rumex maritimus* wetland fringe appeared in 2006. In 2008 the wetland fringe was reduced to one-foot, and further reduced in 2009 to six to ten inches (**Chart 3**). This reduction in wetland fringe is a result of high water and wave action. However, these conditions have given rise to the expansion of the Type 8 – Algae / Aquatic Plant community in 2008 and 2009 (**Chart 3**). In summary the 2004 upland has primarily developed into transitional open water of 2005 through 2007, which in 2008 and 2009 has become aquatic bed wetland (**Chart 4**).

Table 3: ***Data summary for Transect 2 at the Little Muddy Wetland Mitigation Site.***

Monitoring Year	2004	2005	2006	2007	2008	2009
Transect Length (feet)	310	310	310	310	310	310
# Vegetation Community Transitions along Transect	1	2	3	1	2	2
# Vegetation Communities along Transect	2	3	3	2	3	3
# Hydrophytic Vegetation Communities along Transect	0	0	2	1	2	2
Total Vegetative Species	5	4	7	11	8	10
Total Hydrophytic Species	2	2	4	8	4	6
Total Upland Species	3	2	3	3	4	4
Estimated % Total Vegetative Cover	60	30	14	40	70	58
% Transect Length Comprised of Hydrophytic Vegetation Communities	0	0	2.0	2.0	98	98
% Transect Length Comprised of Upland Vegetation Communities	100	2	2.5	2.5	2	2
% Transect Length Comprised of Unvegetated Open Water	0	96	95.5	93.0	0	0
% Transect Length Comprised of Bare Substrate	0	1	0.0	2.5	0	0

Chart 3: ***Transect maps showing vegetation types of Transect 2 from start (0 feet) to end (310 feet) from 2004 to 2009.***

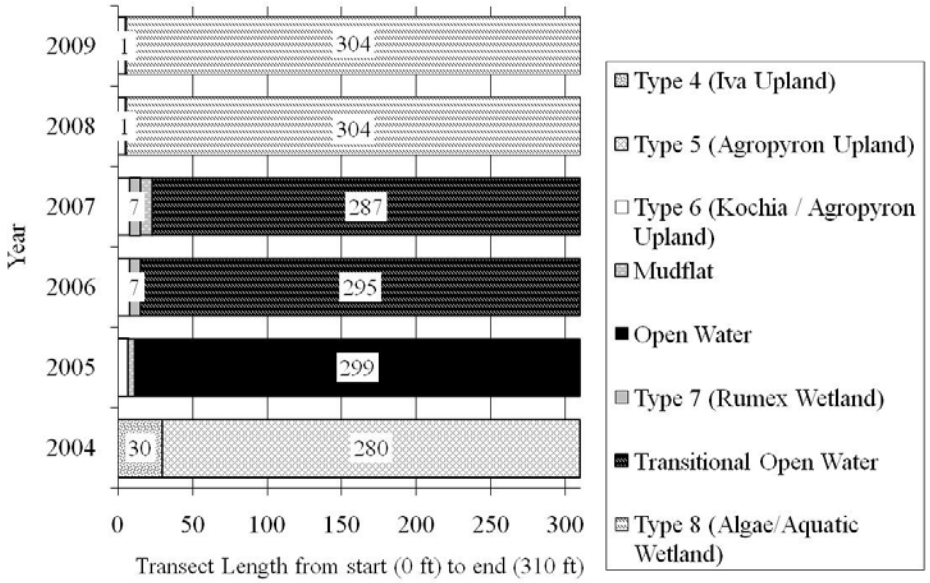
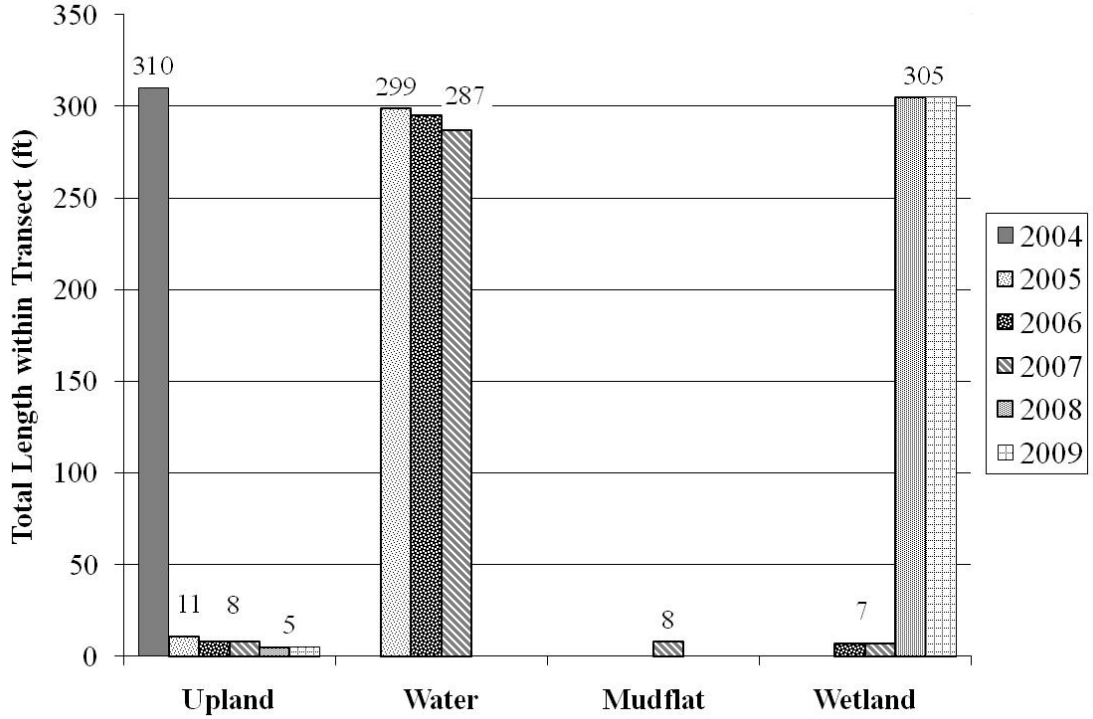


Chart 4: ***Length of vegetation communities within Transect 2 from 2004 to 2009.***



Canada thistle (*Cirsium arvense*) has been the only State noxious weed found within the confines of the berm from 2006 to 2009. All infestations have occurred in the north-central portion of the project area; however, in 2009 several individuals were found in the south-central portion of the project area **(Figure 3** in **Appendix A**). Those in the south-central area were pulled, bagged, and removed by the Botanist during monitoring. The Canada thistle populations from 2006 through 2008 have grown. The densest Canada thistle areas were mapped as upland islands (**Photos 25-26** in **Appendix C**). However, Canada thistle plants are prevalent in Types 11 and 14, but in densities conducive for wetland determination.

Outside the berm another State noxious weed has been present, *Cardaria draba.* In 2008 it appeared to be less abundant than in previous years. Many of the plants observed in the spring of 2009 appeared to be sprayed prior to the August 2009 visit. The landowner has been chemically controlling noxious and exotic weeds outside the project site since at least 2002.

3.3 Soils

Prior to construction of the wetland mitigation site, the project site was composed of three soil types: *Absher-Noble Complex, 0-5% slopes*; *Marvan Clay, 0-2% slopes*; and *Lallie Silty Clay Loam* (USDA 1982). These soil types are conducive for creating ponds due to their high clay content and low permeability (USDA 1982). However, major excavation was performed to create a depression and build the surrounding berms; thereby, greatly disturbing these soil types.

In 2005 to 2009, these soil types were all inundated. Matrix soil colors and textures have mostly remained the same since 2005. Clay soil textures had matrix colors ranging from 2.5Y 4/1 to 2.5

5/2 (**COE Forms** in **Appendix B**). In 2007, some soil layers exhibited mottles ranging from 10YR 4/6 to 10YR 5/8. Only one pit in each of 2008 and 2009 exhibited mottles within the soil layers (**COE Forms** in **Appendix B**).

3.4 Wetland Delineation

Prior to project implementation, no wetland habitat existed within the main project site; however, three small emergent wetlands did occur in association with Little Muddy Creek (LWC 2002). No previously delineated wetlands were filled in during the construction of this mitigation site.

Wetland development occurred for the first time in 2006 and has increased in area each year. Approximately 163 acres of wetlands and 27 acres of transitional open water were mapped in 2009 (**Figure 3** in **Appendix B**). In 2009, transitional open water, mudflat, and upland decreased while a diverse array of wetland community types increased (**Table 4**).

Table 4: ***Acreages for each wetland community from 2007 through 2009 at the Little Muddy Creek Wetland Mitigation Site.***

WETLAND COMMUNITY	ACREAGE		
	2007	2008	2009
Type 7 – *Rumex maritimus* Wetland Fringe	0.24	1.43	1.54
Type 8 – *Polygonum / Potamogeton* Wetland – Algae / Aquatic Wetland	---	69.38	119.52
Type 9 – *Polygonum aviculare* Wetland	30.84	---	---
Type 10 – *Typha latifolia* Wetland	0.57	9.76	9.55
Type 11 – *Hordeum jubatum* Wetland	12.76	13.61	6.92
Type 9/11 – *Polygonum* / *Hordeum* Wetland	19.12	6.23	1.79
Type 10/11 – *Typha* / *Hordeum* Wetland	1.15	---	---
Type 12 – *Alisma gramineum* Wetland	0.38	0.39	0.39
Type 14 – *Rumex* / *Eleocharis* Wetland	---	9.47	23.11
Total Wetland Habitat	**65.06**	**110.27**	**162.82**

3.5 Fish and Wildlife

Direct observations of all wildlife species and signs indicating their presence have been compiled since 2004 (**Table 5**; **Appendix B)**. A dramatic change in bird guilds was observed from 2004 to 2005. The bird guilds observed in 2005 have been present during all site visits through 2009. In 2009 approximately 29 species of shorebirds, waterfowl, and gulls inhabited the site (**Table 5**). Changes in the mammalian, amphibian, and reptilian communities have also been noticeable since 2004 (**Table 5**). While pronghorns were the dominant mammal in 2004 and 2005, they are now observed along with white-tailed deer and mule deer. Coyotes and foxes have been observed predating in the project area. Few amphibians or reptiles have been observed (**Table 5**).

Table 5: ***Fish and wildlife species observed within the Little Muddy Creek Wetland Mitigation Site in 2004 to 2009.***

FISH, AMPHIBIAN, and REPTILE	
Common Carp (*Cyprinus carpio*)	Western Chorus Frog (*Pseudacris triseriata*)
Plains Garter Snake (*Thamnophis radix*)	
BIRD	
American Avocet (*Recurvirostra americana*)	Lesser Scaup (*Aythya affinis*)
American Coot (*Fulica americana*)	Lesser Yellowlegs (*Tringa flavipes*)
American Wigeon (*Anas americana*)	**Long-billed Curlew (*Numenius americanus*)**
American White Pelican	Long-billed Dowitcher (*Limnodromus scolopaceus*)
(*Pelecanus erythrorhynchos*)	**Mallard (*Anas platyrhynchos*)**
Blue-winged Teal (*Anas discors*)	Marbled Godwit (*Limosa fedoa*)
Brewer's Blackbird (*Euphagus cyanocephalus*)	Mourning Dove (*Zenaida macroura*)
Bufflehead (*Bucephala albeola*)	Northern Harrier (*Circus cyaneus*)
Canada Goose (*Branta Canadensis*)	**Northern Pintail (*Anas acuta*)**
Canvasback (*Aythya valisineria*)	**Northern Shoveler (*Anas clypeata*)**
Cinnamon Teal (*Anas cyanoptera*)	**Redhead (*Aythya americana*)**
Common Raven (*Corvus corax*)	**Red-winged Blackbird (*Agelaius phoeniceus*)**
Common Snipe (*Gallinago gallinago*)	Ring-necked Duck (*Aythya collaris*)
Common Tern (*Sterna hirundo*)	Ruddy Duck (*Oxyura jamaicensis*)
Double-crested Cormorant (*Phalacrocorax auri*tus)	**Sandhill Crane (*Grus Canadensis*)**
Eared Grebe (*Podiceps nigricollis*)	**Sandpiper (unidentified species)**
Eurasian Wigeon (*Anas penelope*)	**Sparrow (unidentified species)**
Ferruginous Hawk (*Buteo regalis*)	Tree Swallow (*Tachycineta bicolor*)
Franklin's Gull (*Larus pipixcan*)	Trumpeter Swan (*Cygnus buccinator*)
Gadwall (*Anas strepera*)	**Tundra Swan (*Cygnus columbianus*)**
Golden Eagle (*Aquila chrysaetos*)	Vesper Sparrow (*Pooecetes gramineus*)
Great Blue Heron (*Ardea herodias*)	**Western Meadowlark (*Sturnella neglecta*)**
Green-winged Teal (*Anas crecca*)	Willet (*Catoptrophorus semipalmatus*)
Horned Grebe (*Podiceps auritus*)	**Wilson's Phalarope (*Phalaropus tricolor*)**
Horned Lark (*Eremophila alpestris*)	**Yellow-headed Blackbird (*Xanthocephalus**
Killdeer (*Charadrius vociferous*)	***xanthocephalus*)**
MAMMAL	
American Badger (*Taxidea taxus*)	**Red Fox (*Vulpes vulpes*)**
Common Raccoon (*Procyon lotor*)	Richardson's Ground Squirrel
Coyote (*Canis latrans*)	(*Spermophilus richardsonii*)
Mule Deer (*Odocoileus hemionus*)	White-tailed Deer (*Odocoileus virginianus*)
Pronghorn (*Antilocapra americana*)	

Bolded species were observed in 2008.

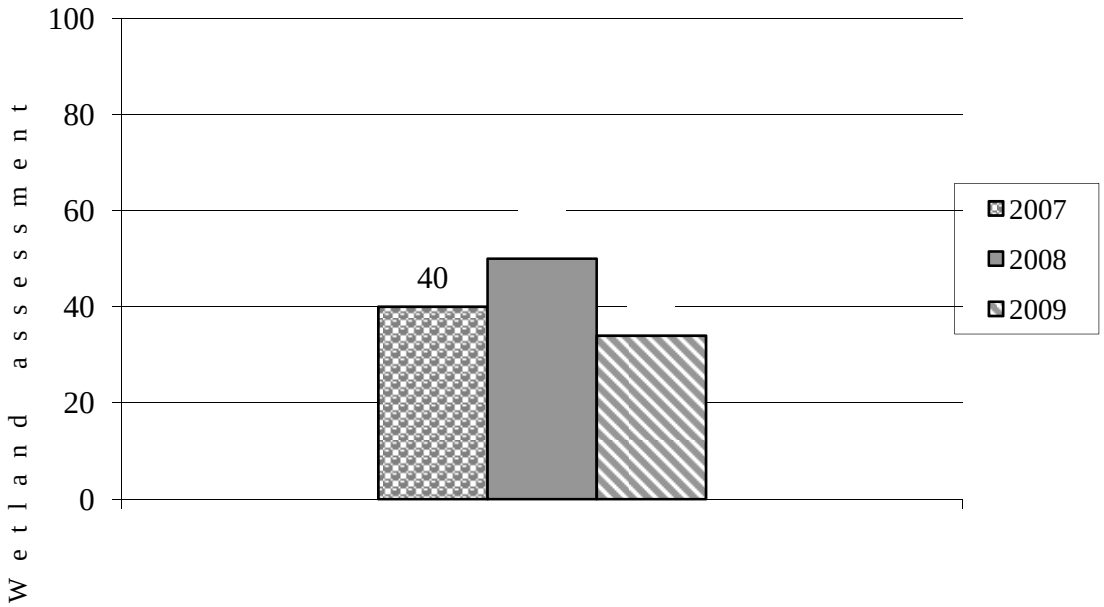
3.6 Macroinvertebrates

Aquatic macroinvertebrates were not sampled from 2004 to 2006. However, dragonflies, damselflies, and mosquito adults and larvae were observed during the spring visits of 2005 and 2006. Mosquitoes are a major prey of dragonflies and damselflies (Merritt and Cummins 1984).

One macroinvertebrate sample was collected in each year from 2007 to 2009 (**Photo 16** in **Appendix C**). The 2009 sampling results are provided in **Appendix F** and were summarized by Rhithron Associates, Inc. in the italicized section below.

*The assemblage sampled in 2009 from the Little Muddy Creek wetland was similar in composition to that of 2008. Midges in the Cricotopus (Isocladius) group continued to dominate the invertebrate fauna; their abundance suggests the presence of filamentous algae. The functional composition of the assemblage also remained stable between the 2 years: shredders and gatherers were abundant in both years. Thermal preference of the 2009 assemblage was estimated to be 17.3ºC. As before, the fauna is mostly limited to air-breathers and hemoglobin-bearers, suggesting hypoxic conditions in both water and substrates. The bioassessment index indicated "sub-optimal" conditions (**Chart 5**).*

Chart 5: ***Bioassessment scores using the wetland index at the Little Muddy Creek Wetland Mitigation Site from 2007 to 2009.***



In 2007 poor biotic conditions occupied by low numbers of seed shrimp (Class Ostracoda) and water boatman (Family Corixidae) were found. This was likely a result of newly developing aquatic habitat and an overabundance of green algae in the water. In 2008, biotic conditions improved, and 14 taxa were found. In 2009 biotic conditions declined, but 14 taxa were still found. The 2009 sample contained non-insect species, such as, mites/ticks (Taxon Acari), small crustaceans (Class Copepoda), seed shrimps (Ostracoda), and freshwater snails (Family Lymnaeidae) (**Appendix F**). The 2009 sample contained aquatic insects, such as, damselflies/dragonflies (Order Odonata), true flies (Order Diptera), beetles (Order Coleoptera), water boatman (Family Corixidae), and non-biting midges (Family Chironomidae) (**Appendix F**).

3.7 Functional Assessment

As wetlands have developed, so have their associated functions and values. However, the methods for assessing wetland functions and values have changed. The 2006 and 2007 wetland habitats were assessed using the 1999 MDT MWAM. The 2008 and 2009 wetland habitats have been assessed using the 2008 MDT MWAM. Although direct comparisons cannot be made,

general trends in wetland development can still be determined (**Table 6**). As in 2006 and 2007, the Little Muddy Creek Wetland Mitigation Site continued to rate as a Category II wetland because it rates as exceptional for wildlife habitat (**Table 6**). The site rated high for Short and Long Term Surface Water Storage; Sediment/Nutrient/Toxicant Removal; and Production Export/Food Chain Support (**Table 6).**

Table 6: ***Summary of 2006 through 2009 wetland function/value ratings and functional points at the Little Muddy Creek Wetland Mitigation Site.***

Function and Value Parameters from the MDT Montana Wetland Assessment Method[1]	2006[1]	2007[1]	2008[2]	2009[2]
Listed/Proposed T&E Species Habitat	Mod (0.7)	Low (0.0)	Low (0.0)	Low (0.0)
MTNHP Species Habitat	Low (0.1)	Mod (0.6)	Mod (0.6)	Mod (0.6)
General Wildlife Habitat	Exc (1.0)	Exc (1.0)	Exc (1.0)	Exc (1.0)
General Fish/Aquatic Habitat	Mod (0.4)	Mod (0.4)	Low (0.2)	Low (0.2)
Flood Attenuation	Mod (0.6)	Mod (0.6)	Mod (0.6)	Mod (0.6)
Short and Long Term Surface Water Storage	High (1.0)	High (1.0)	High (1.0)	High (1.0)
Sediment/Nutrient/Toxicant Removal	Mod (0.7)	Mod (0.7)	High (1.0)	High (1.0)
Sediment/Shoreline Stabilization	Low (0.3)	Low (0.3)	Low (0.3)	Low (0.3)
Production Export/Food Chain Support	High (0.9)	High (0.8)	High (0.9)	High (0.9)
Groundwater Discharge/Recharge	Low (0.1)	Low (0.1)	Low (0.1)	Low (0.1)
Uniqueness	Mod (0.4)	Mod (0.4)	Mod (0.4)	Mod (0.4)
Recreation/Education Potential	Mod (0.7)	Mod (0.7)	Mod (0.1)	Mod (0.1)
Actual Points/Possible Points	**6.9 / 12**	**6.6 / 12**	**6.2 / 11**	**6.2 / 11**
% of Possible Score Achieved	**58%**	**55%**	**56%**	**56%**
Overall Category	**II**	**II**	**II**	**II**
Total Acreage of Assessed Wetlands and Other Aquatic Habitats within Site Boundaries (ac)	**188.25**	**156.44**	**181.12**	**189.81**
Functional Units (acreage x actual points)	**1298.93**	**1032.50**	**1122.94**	**1176.82**

[1] Assessed using the 1999 MWAM.
[2] Assessed using the 2008 MWAM; Completed assessment can be found in **Appendix B**.

3.8 Photographs

Representative photos taken from six photo-points (**Photos 1-9**), two transects (**Photos 10-11**), and of the general project area (**Photos 12-30**) are provided in **Appendix C**. The 2009 aerial photograph taken on July 2nd was used as a base for **Figures 2** and **3** (**Appendix A**).

3.9 Maintenance Needs / Recommendations

The berm, excavated channels, and inlet/outlet structures were in good condition during the mid-season visit of 2009. During the initial filling of the site, water was released in phases in order to prevent erosion of the berm. Vegetation on the berm has grown dense and tall. In 2006 it was suggested that extremely wide and deep cracks on the berm near PP-5 should be monitored. However, these cracks were much shallower in 2007 and 2008, indicating they are ephemeral and a result of how the soil responds to precipitation events.

In 2008 the landowner expressed concern over six locations of eroding bank in the northeast corner of the project (**Photos 27-30** in **Appendix C**). The erosion is a result of wind action on a nearly full pool of water. The site was examined at various times during the spring and summer by PBS&J, MDT, and Ducks Unlimited. Ducks Unlimited will be working to reduce the erosion in the fall of 2009.

Within the monitoring limits, Canada thistle occupied 0.65 acre in 2009. This was much less than the 1.62 acres it occupied in 2008. However, Canada thistle is present over a greater area than the 0.65 acres implies. The densest patches of Canada thistle were delineated and considered upland. A significant portion of wetland Types 11 and 14 contain Canada thistle, but in quantities low enough to be considered as wetland. Canada thistle is spreading as shown by the plants pulled in the southwest portion of the project area. Canada thistle within the project area has not been controlled. Although inundation will help decrease populations, seed will continue to colonize suitable habitat within the project area.

3.10 Current Credit Summary

As of 2009, the Little Muddy site has developed approximately 162.82 acres of Class II wetland and 26.99 acres of transitional open water (**Figure 3** in **Appendix A**). Additionally, the site has developed over 1,100 functional units (**Table 6**). The COE anticipated that the project would result in the establishment of emergent marsh and some shallow water habitat, with diversity accomplished through fluctuating water levels. No specific performance criteria or ratios were stipulated in COE correspondence regarding the project (Steinle 2001; Steinle 2002).

It was anticipated by MDT that approximately 13.57 acres of compensatory wetland mitigation credit could be needed to offset impacts associated with ten different projects within the Missouri-Sun-Smith River watershed (#7) (MDT 2002). An additional 50 acres of reserve credit were also being sought by MDT (MDT 2002). Thus, MDT originally sought a total 63.57 acres of compensatory wetland mitigation credit.

Approximately 0.80 acre, 9.97 acres, and 2.80 acres of these 13.57-acre impacts were projected at Class II, III, and IV wetlands, respectively (**Table 6**). The COE approved application of these projected impact acres to the Little Muddy site as previously “owed” mitigation, with the exception of the Bowman’s Corner project, which comprised 10.7 of the 13.57 projected impact acres (Steinle 2002). Consequently, 2.87 acres of “owed” mitigation was approved for application against the Little Muddy site, with any additional projects (including Bowman’s Corner) to be applied against the 50-acre “reserve”. Final application of projected or incurred

wetland impacts against this mitigation site are subject to ongoing discussions and specific agreements between the COE and MDT. As of 2009, the site appears to be developing the anticipated target credits.

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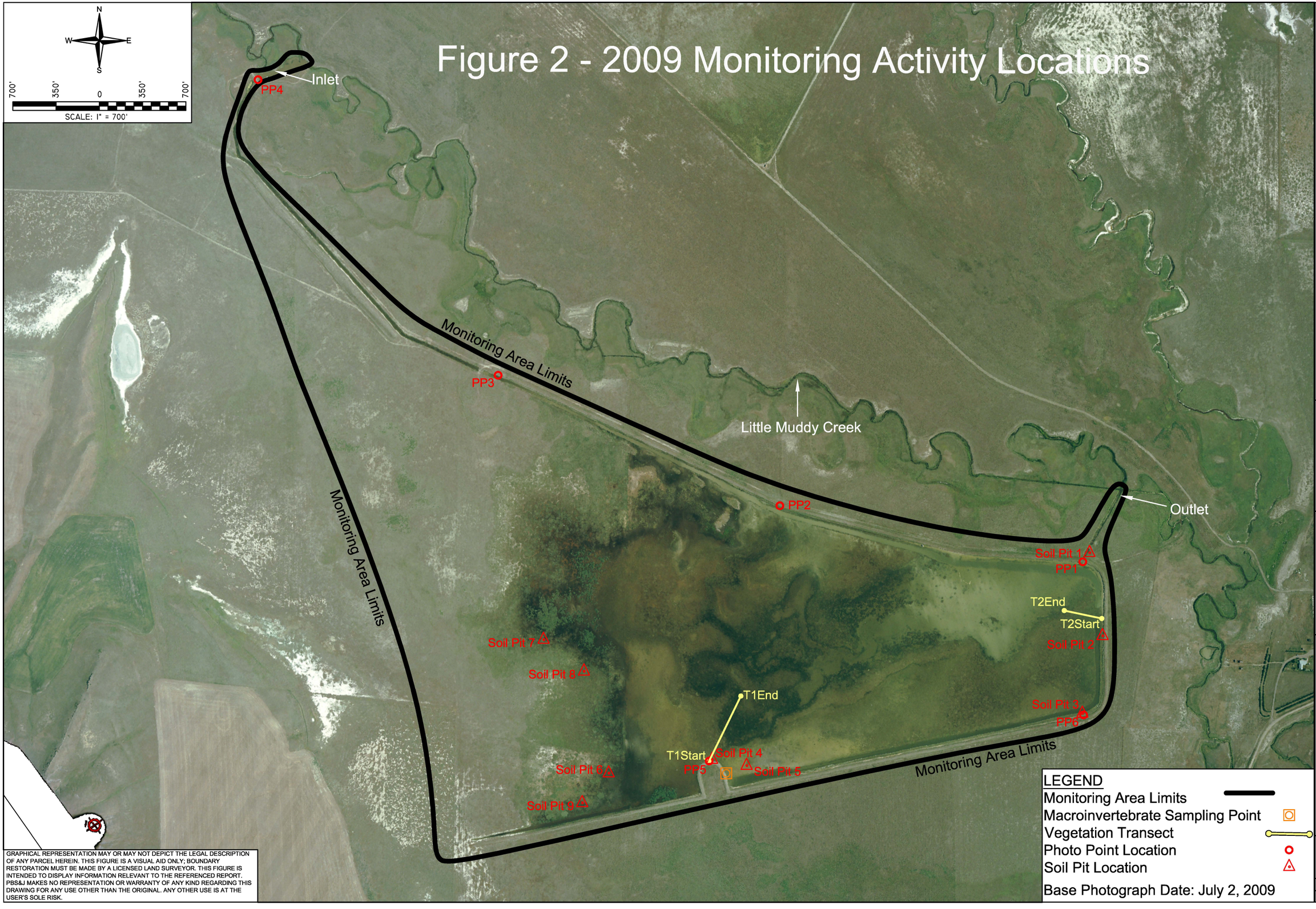
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Appendix A

FIGURES 2 & 3

MDT Wetland Mitigation Monitoring
Little Muddy Creek
Cascade County, Montana

Figure 2 - 2009 Monitoring Activity Locations



LEGEND

- Monitoring Area Limits
- Macroinvertebrate Sampling Point
- Vegetation Transect
- Photo Point Location
- Soil Pit Location

Base Photograph Date: July 2, 2009

GRAPHICAL REPRESENTATION MAY OR MAY NOT DEPICT THE LEGAL DESCRIPTION OF ANY PARCEL HEREIN. THIS FIGURE IS A VISUAL AID ONLY; BOUNDARY RESTORATION MUST BE MADE BY A LICENSED LAND SURVEYOR. THIS FIGURE IS INTENDED TO DISPLAY INFORMATION RELEVANT TO THE REFERENCED REPORT. PBS&J MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND REGARDING THIS DRAWING FOR ANY USE OTHER THAN THE ORIGINAL. ANY OTHER USE IS AT THE USER'S SOLE RISK.

LITTLE MUDDY CREEK WETLAND MITIGATION

2009 MONITORING ACTIVITY LOCATIONS

DRAWN: JR
PROJ MGR: J. BERGLUND
CHECKED: AP
APPV'D: JB
PLOTTED: Nov/17/2009

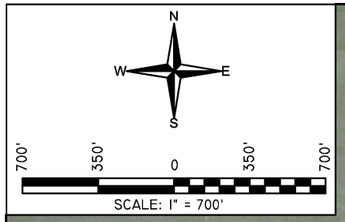
PROJ NO: 0B4308802.04.03
LOCATION: CASCADE, MT
SCALE: NOTED
FILE NAME: BASE2009.dwg

801 N. Last Chance Gulch
Suite 101
Helena, MT 59601

FIGURE
2

REV -
DATE 10/13/2009

Figure 3 - 2009 Mapped Site Features



Wetland Fringe
2' wide Type 7

Wetland Fringe
2' wide Type⑦

Monitoring Area Limits

Wetland Fringe
2' wide Type⑦

Wetland Fringe
2' wide Type⑦

Wetland Fringe
2' wide Type⑦

Berm =⑥

Eroding Bank

Transitional
Open Water

Wetland Fringe
1' wide Type⑦

Monitoring Area Limits

Grass Upland

Berm =⑥

Wetland Fringe
2' wide Type⑦

Wetland Fringe
4' wide Type⑦

Wetland Fringe
5' wide Type⑦

Inlet Wetland Fringe
6' wide Type⑦

LEGEND

- Monitoring Area Limits
- Wetland Boundary
- Transitional Open Water
- Vegetation Community Boundary
- Eroding Bank

Noxious Weeds

Cirsium arvense

Infestation Size

- ✖ = < 0.1 acre
- ▲ = 0.1 to 1 acre

Cover Class

- L = Low (1-5% cover)
- H = High (25-100% cover)

Base Photograph Date: July 02, 2009

WETLAND AREA

Gross Wetland Area	189.81 acres
Transitional Open Water	26.99 acres
Net Wetland	162.82 acres

Vegetation Community Types

- ⑥ Kochia/Agropyron Upland
- ⑦ Rumex maritimus Wetland Fringe
- ⑧ Algae/Aquatic Plant Wetland
- ⑨/⑪ Polygonum/Hordeum Wetland
- ⑩ Typha latifolia Wetland
- ⑪ Hordeum jubatum Wetland
- ⑫ Alisma gramineum Wetland
- ⑬ Upland
- ⑭ Rumex/Eleocharis Wetland

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LITTLE MUDDY CREEK WETLAND MITIGATION

2009 MAPPED SITE FEATURES

DRAWN: JR | PROJ MGR: J. BERGLUND | CHECKED: AP | APPVD: JB | PLOTTED: Oct/22/2009

PROJ NO: 0B4308802 04.03 | LOCATION: CASCADE, MT | SCALE: NOTED | FILE NAME: BASE2009.dwg

801 N. Last Chance Gulch
Suite 101
Helena, MT 59601

PBSJ

FIGURE
3

REV -

DATE 10/21/2009

Appendix B

2009 WETLAND MITIGATION SITE MONITORING FORM
2009 BIRD SURVEY FORM
2009 COE WETLAND DELINEATION FORMS
2009 MDT FUNCTIONAL ASSESSMENT FORM

MDT Wetland Mitigation Monitoring
Little Muddy Creek
Cascade County, Montana

PBS&J / MDT WETLAND MITIGATION SITE MONITORING FORM

Project Name: **Little Muddy Wetland** Project Number: **0B4308802-04.03**
Assessment Date: **August 3, 2009** Person(s) conducting the assessment: **A. Pipp**
Location: **9 miles SW of Ulm** MDT District: **Great Falls** Milepost: _____
Legal Description: T **19N** R **1E** Section **30, 31, 32**
Weather Conditions: **cloudy, 70's-80's, 5-10mph winds** Time of Day: **9:00am-7:00pm**
Initial Evaluation Date: **June 4, 2004** Monitoring Year: **6** # Visits in Year: **2**
Size of evaluation area: **406 acres** Land use surrounding wetland: **dryland agriculture**

HYDROLOGY

Surface Water Source: **Little Muddy Creek**
Inundation: **Present** Average Depth: **2 feet** Range of Depths: **0.0 to 8.0**
Percent of assessment area under inundation: **85%**
Depth at emergent vegetation-open water boundary: **site specific: 1 or 8 feet**
If assessment area is not inundated then are the soils saturated within 12 inches of surface: _
Other evidence of hydrology on the site (ex. – drift lines, erosion, stained vegetation, etc.):

_____

Groundwater Monitoring Wells: **Absent**
Record depth of water below ground surface (in feet):

Well Number	Depth	Well Number	Depth	Well Number	Depth

Additional Activities Checklist:
☒ Map emergent vegetation-open water boundary on aerial photograph.
☒ Observe extent of surface water during each site visit and look for evidence of past surface water elevations (drift lines, erosion, vegetation staining, etc.)
☒ Use GPS to survey groundwater monitoring well locations, if present.

COMMENTS / PROBLEMS:
The site was completely filled with water from Little Muddy Creek. In addition the site received more precipitation than typical for July and August.

VEGETATION COMMUNITIES

Community Number: **1** Community Title (main spp): **Elymus varnensis**

Dominant Species	% Cover	Dominant Species	% Cover
Elymus varnensis	5 = > 50%	Melilotus officinale	1 = 1-5%
Bromus japonicus*	1 = 1-5%	Sisymbrium altissimum	1 = 1-5%
Hordeum jubatum	+ = < 1%	Tragopogon dubius	+ = < 1%

Comments / Problems: **Plant species and % coverage reflects conditions in 2004. Entire community became Open Water in 2005 and other communities in 2006-2008. *Previously identified incorrectly as Festuca spp.**

Community Number: **2** Community Title (main spp): **Avena**

Dominant Species	% Cover	Dominant Species	% Cover
Elymus varnensis	1 = 1-5%	Avena/Bromus*	5 = > 50%
Lactuca serriola	+ = < 1%		

Comments / Problems: **Plant species and % coverage reflects conditions in 2004. Entire community became Open Water in 2005 and other communities in 2006-2007. *Bromus was previously identified incorrectly as Festuca spp.**

Community Number: **3** Community Title (main spp): **Kochia scoparia**

Dominant Species	% Cover	Dominant Species	% Cover
Avena spp.	2 = 6-10%	Kochia scoparia	5 = > 50%
Bromus japonicus*	1 = 1-5%	Lactuca serriola	1 = 1-5%
Helianthus annuus	2 = 6-10%	Polygonum spp.	1 = 1-5%

Comments / Problems: **Plant species and % coverage reflects conditions in 2004. Entire community became Open Water in 2005 and other communities in 2006-2008. *Previously identified incorrectly as Festuca spp.**

Community Number: **4** Community Title (main spp): **Iva axillaris**

Dominant Species	% Cover	Dominant Species	% Cover
Agropyron cristatum	2 = 6-10%	Iva axillaris	4 = 21-50%
Lactuca serriola	1 = 1-5%		

Comments / Problems: **Plant species and % coverage reflects conditions in 2004. Entire community became Open Water in 2005 and other communities in 2006-2008.**

VEGETATION COMMUNITIES (continued)

Community Number: **5** Community Title (main spp): **Agropyron cristatum**

Dominant Species	% Cover	Dominant Species	% Cover
Agropyron cristatum	5 = > 50%	Kochia scoparia	5 = > 50%
Elymus hispidus	2 = 6-10%	Lactuca serriola	+ = < 1%

Comments / Problems: **Plant species and % coverage reflects conditions in 2004. Entire community became Open Water in 2005 and other communities in 2006-2008.**

Community Number: **6** Community Title (main spp): **Kochia / Agropyron**

Dominant Species	% Cover	Dominant Species	% Cover
Kochia scoparia	4 = 21-50%	Iva axillaris	+ = < 1%
Elymus varnensis	3 = 11-20%	Agropyron cristatum	2 = 6-10%
Agropyron intermedium	2 = 6-10%	Hordeum jubatum	1 = 1-5%
Polygonum douglassii	+ = < 1%	Helianthus annuus	1 = 1-5%

Comments / Problems: **In 2006-2007, this community occupied some of the upland shoreline and all of the berm. In 2008, this community occupied only the berm.**

Community Number: **7** Community Title (main spp): **Rumex maritimus**

Dominant Species	% Cover	Dominant Species	% Cover
Rumex maritimus	3 = 11-20%	Scirpus (maritimus)	+ = < 1%
Hordeum jubatum	3 = 11-20%	Chenopodium album	2 = 6-10%
Rumex crispus	2 = 6-10%		
Rorippa sinuata	+ = < 1%		
Kochia scoparia	2 = 6-10%		
Salix lutea	+ = < 1%		

Comments / Problems: **From 2006-2009, this community developed as a wetland fringe along the inlet channel (except where bank erosion occurred in 2008-2009). .**

Community Number: **8** Community Title (main spp): **Type 8 - Algae / Aquatic Plant**

Dominant Species	% Cover	Dominant Species	% Cover
Polygonum aviculare	1 = 1-5%		
Potamogeton pectinatus	3 = 11-20%		
Potamogeton (amplifolius ?)	3 = 11-20%		
Alisma gramineum	3 = 11-20%		
Green Algae (since 2007)	4 = 21-50%		

Comments / Problems: **In 2006, this community was named Polygonum/Potamogeton and these species were found growing up through Open Water. In 2007, aquatic plants were not observed and all surface water was filled with a green algal bloom. In 2008-2009, this community re-appeared, but the name was changed. Percent cover is hard to determine due to inundation.**

VEGETATION COMMUNITIES (continued)

Community Number: **9** Community Title (main spp): **Type 9 - Polygonum aviculare**

Dominant Species	% Cover	Dominant Species	% Cover
Polygonum aviculare	3 = 11-20%	Rumex maritimus	2 = 6-10%
Typha latifolia	3 = 11-20%	Rumex crispus	1 = 1-5%
Sisymbrium spp. (dead in 2008)			
Agropyron smithii	1 = 1-5%		
Hordeum jubatum	3 = 11-20%		
algae	1 = 1-5%		

Comments / Problems: **In 2006, this community dominated land that became exposed as the Open Water receded. In 2007 this community dominated where land remained saturated. In 2007-2009 this community also occurred in drier areas or in newly exposed mudflat and mixed with Hordeum or Rumex.**

Community Number: **10** Community Title (main spp): **Type 10 - Typha latifolia**

Dominant Species	% Cover	Dominant Species	% Cover
Typha latifolia	5 = > 50%	Rumex crispus	+ = < 1%
Sisymbrium spp. (dead in 2008)		Rumex maritimus	+ = < 1%
Polygonum aviculare (absent in 2009)		Agropyron (all species)	2 = 6-10%
Hordeum jubatum	1 = 1-5%		
Bromus japonicus	1 = 1-5%		
Kochia scoparia (not seen in 2009)			

Comments / Problems: **In 2006, this community was developing on land exposed when the Open Water receded. In 2007, this community was drying out being invaded in August by other plants. In 2008 Typha clumps were present within the Polygonum and Hordeum communities. In 2009 the Typha community was a strong-hold.**

Community Number: **11** Community Title (main spp): **Type 11 - Hordeum jubatum**

Dominant Species	% Cover	Dominant Species	% Cover
Hordeum jubatum	5 = > 50%	Rumex maritimus	3 = 11-20%
Typha latifolia	1 = 1-5%	Agropyron - all species	2 = 6-10%
Sisymbrium sp. (absent in 2009)			
Rumex crispus	2 = 6-10%		

Comments / Problems: **In 2006-2007, this community developed on land that was saturated, but may not have been inundated. In 2007, Hordeum comprised almost 100% coverage. In 2008-2009 Hordeum was evenly scattered where water receded.**

VEGETATION COMMUNITIES (continued)

Community Number: **12** Community Title (main spp): **Type 12 - Alisma gramineum**

Dominant Species	% Cover	Dominant Species	% Cover
Alisma gramineum	2 = 6-10%	Eleocharis palustris	2 = 6-10%
Scirpus acutus	3 = 11-20%		
Hordeum jubatum	1 = 1-5%		
Rumex maritimus	2 = 6-10%		
Typha latifolia	3 = 11-20%		
Chenopodium glaucum	+ = < 1%		

Comments / Problems: **In 2006, this community developed in the outlet channel. Alisma coverage greatly declined due to dry conditions. In 2008-2009, Alisma was abundant, but Typha, Scirpus, and Eleocharis were more abundant.**

Community Number: **13** Community Title (main spp): **Type 13 - Upland**

Dominant Species	% Cover	Dominant Species	% Cover
Cirsium arvense	2 = 6-10%	Chenopodium album	1 = 1-5%
Agropyron smithii	2 = 6-10%	Agropyron varnensis	2 = 6-10%
Elymus varnensis	2 = 6-10%	Agropyron intermedium	1 = 1-5%
Bromus japonicus	4 = 21-50%	FAC, FACW, OBL plants	1 = 1-5%
Sisymbrium spp.	2 = 6-10%		
Kochia scoparia	2 = 6-10%		

Comments / Problems: **In 2006, this community occurred as islands and created the boundary on the west side of the project area. In 2007 these islands expanded where soils dried early in the growing season. In 2008 upland decreased though islands of Cirsium increased. In 2009 upland decreased.**

Community Number: **14** Community Title (main spp): **Rumex / Eleocharis Wetland**

Dominant Species	% Cover	Dominant Species	% Cover
Rumex maritimus	4 = 21-50%	Hordeum jubatum	2 = 6-10%
Eleocharis palustris	2 = 6-10%		
Typha latifolia	+ = < 1%		
Aquatic Plants	2 = 6-10%		
Green Algae	3 = 11-20%		
Rumex crispus	1 = 1-5%		

Comments / Problems: **This is a new community in 2008, though it is probably transitory. Rumex and Eleocharis grew sparsely though evenly throughout the inundated polygon. In 2009 this community expanded and Rumex was the dominant species.**

Community Number: ___ Community Title (main spp): _____

Dominant Species	% Cover	Dominant Species	% Cover

Comments / Problems: _____

Additional Activities Checklist:

☒ Record and map vegetative communities on aerial photograph.

COMPREHENSIVE VEGETATION LIST

Plant Species	Vegetation Community Number (s)	Plant Species	Vegetation Community Number (s)
Agropyron cristatum	5, 6,13	Polygonum aviculare	7, 8-10, 11
Agropyron smithii	1-6, 13	Polygonum douglassii	7
algae, green	Water, 8, 14	Populus tremuloides	10
Alisma gramineum	8, 12	Potamogeton (amplifolius?)	8
Alopecurus arundinaceus	9, 11, 14	Potamogeton pectinatus	8
Arctium minus	1-5	Rorippa sinuata	7
Artemisia frigida	3	Rosa spp.	1-5, inlet chan
Aster pansus	5, 6	Rumex crispus	7, 9, 10, 11
Atriplex rosea (A. argentea)	1-5	Rumex maritimus	7, 9-12, 14
Bromus inermis	1-6, 13	Salix exigua	7, 10
Bromus japonicus	6, 13	Salix lutea	7, 10
Cardaria pubescens	1-5	Salsola iberica (syn. S. kali)	1-5
Chenopodium album	6, 7, 11, 13	Scirpus acutus	7, 12
Chenopodium glaucum	10, 11, 12, 13	Scirpus maritimus	7
Chenopodium leptophyllum	10, 13	Scirpus pungens	7, 12
Chenopodium (rubrum)	11	Sisymbium altissimum	1-6, 11-13
Chenopodium spp.	6	Sisymbrium spp.	9-11, 13
Cirsium arvense	1-5, 6, 13	Sonchus arvensis	6, 13
Eleocharis palustris	10-12, 14	Thlaspi arvensis	6, 13
Elymus hispidus (Agropyron intermedium)	5, 6, 13	Tragopogon dubuis	1-6, 11, 13
Elymus varnensis	1-2, 6, 10, 13	Typha latifolia	7, 9-12, 14
Grindelia squarrosa	1-5, 6, 13		
Helianthus annuus	3, 6, 13		
Hordeum jubatum	1-7, 9-12		
Iva axillaris	1-6, 9, 11, 13		
Kochia scoparia	5-7, 11, 13		
Lactuca serriola	2-6, 11, 13		
Medicago sativa	1-6		
Melilotus alba	13, 7		
Melilotus officinale	1-5, 13, 7		

Comments / Problems: _____

PLANTED WOODY VEGETATION SURVIVAL

Plant Species	Number Originally Planted	Number Observed	Mortality Causes
NONE			

Comments / Problems: N/A

WILDLIFE

Birds

Were man-made nesting structures installed? **No**
If yes, type of structure: _____ How many? _____
Are the nesting structures being used? **NA**
Do the nesting structures need repairs? _____

Mammals, Herptiles, and Fish

Species	Number Observed	Indirect Indication of Use			
		Tracks	Scat	Burrows	Other
American pronghorn	1	☐	☐	☐	
red fox	1	☐	☐	☐	predating
Carp	several	☐	☐	☐	jumping
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	
		☐	☐	☐	

Additional Activities Checklist:
Yes Macroinvertebrate Sampling (if required)

Comments / Problems: Huge numbers of blue and a red damselfly species (Order Anisoptera) and dragonfly species (Order Zygoptera) were observed. On June 11th, a mule deer doe and fawn and 6 American pronghorn were observed adjacent to the site.

PHOTOGRAPHS

Using a camera with a 50mm lens and color film take photographs of the following permanent reference points listed in the check list below. Record the direction of the photograph using a compass. When at the site for the first time, establish a permanent reference point by setting a ½ inch rebar or fencepost extending 2-3 feet above ground. Survey the location with a resource grade GPS and mark the location on the aerial photograph.

Photograph Checklist:

- ☒ One photograph for each of the four cardinal directions surrounding the wetland.
- ☒ At least one photograph showing upland use surrounding the wetland. If more than one upland exists then take additional photographs.
- ☒ At least one photograph showing the buffer surrounding the wetland.
- ☒ One photograph from each end of the vegetation transect, showing the transect.

Location	Photograph Frame #	Photograph Description	Compass Reading (°)
P-1		From P-1 [see Photo Sheet, Photo 1]	136
P-1		From P-1 [see Photo Sheet, Photo 2]	210
P-1		From behind P-1 [see Photo Sheet, Photo 3]	40
P-2		From P-2	282
P-2		From P-2	246
P-2		From P-2	208
P-2		From P-2	246-208
P-2		From P-2	180
P-2		From P-2	150
P-2		From P-2	108
P-3		From P-3	130
P-3		From P-3	culvert
P-4		From P-4	208
P-4		From P-4 towards diversion dam	71
P-5		From P-5	316
P-6		From P-6	317,283
T-1		From T-1 start	10
T-1		From T-1 end	190
T-2		From T-2 start	266
Misc.		Miscellaneous photographs	

Comments / Problems: **Compass declination set at 16 degrees East in 2005-2009; Declination was set slightly different in 2004.**

GPS SURVEYING

Using a resource grade GPS survey the items on the checklist below. Collect at least 3 location points set at a 5 second recording rate. Record file numbers for site in designated GPS field notebook.

GPS Checklist:

- ☒ Jurisdictional wetland boundary.
- ☒ 4-6 landmarks that are recognizable on the aerial photograph.
- ☒ Start and End points of vegetation transect(s).
- ☒ Photograph reference points.
- ☐ Groundwater monitoring well locations.

Comments / Problems: **Mapped with resource grade GPS and hand-mapped onto the 2008 and 2009 aerial photos.**

WETLAND DELINEATION

(attach COE delineation forms)

At each site conduct these checklist items:

- ☒ Delineate wetlands according to the 1987 Army COE manual.
- ☒ Delineate wetland – upland boundary onto aerial photograph.

Yes Survey wetland – upland boundary with a resource grade GPS survey.

Comments / Problems: _____

FUNCTIONAL ASSESSMENT

(Complete and attach full MDT Montana Wetland Assessment Method field forms.)
(Also attach any completed abbreviated field forms, if used)

Comments / Problems: _____

MAINTENANCE

Were man-made nesting structure installed at this site? **No**
If yes, do they need to be repaired? **NA**
If yes, describe the problems below and indicate if any actions were taken to remedy the problems.

Were man-made structures built or installed to impound water or control water flow into or out of the wetland? **Yes**
If yes, are the structures working properly and in good working order? **Yes**
If no, describe the problems below.

Comments / Problems: _____

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: **Little Muddy** Date: **August 3, 2009** Examiner: **A. Pipp**
Transect Number: **1** Approximate Transect Length: **585 feet** Compass Direction from Start: **10˚** Note: **Open water without a T-1 end; Declination is at 16 degrees.**

Vegetation Type A: **Type 6 - Kochia / Agropyron Upland**	
Length of transect in this type: 0-7 feet	
Plant Species	**Cover**
Kochia scoparia	1 = 1-5%
Helianthus annuus (only outside of belt transect in 2009)	
Agropyron smithii	4 = 21-50%
Elymus varnensis	3 = 11-20%
Hordeum jubatum	1 = 1-5%
Bromus japonicus	3 = 11-20%
Bare Ground (30%)	
Total Vegetative Cover:	70%

Vegetation Type B: **Type 7 - Rumex maritimus Wetland Fringe**	
Length of transect in this type: 7-11 feet	
Plant Species	**Cover**
Hordeum jubatum	4 = 21-50%
Rumex maritimus	4 = 21-50%
Kochia scoparia (not seen in 2008-2009)	
Lactuca serriola (not seen in 2008-2009)	
Thlaspi arvense (not seen in 2008-2009)	
Elymus varnensis (not seen in 2008-2009)	
Rumex crispus	4 = 21-50%
Polygonum aviculare	+ = < 1%
Bare Ground (20%)	
Total Vegetative Cover:	80%

Vegetation Type C: **Type 8 - Algae / Aquatic Plant Wetland**	
Length of transect in this type: 14 to 585 feet	
Plant Species	**Cover**
Polygonum aviculare (dead in 2008; Absent in 2009)	
Potamogeton pectinatus & Alisma gramineum	4 = 21-50%
Hordeum jubatum (not observed in 2008-2009)	
algae, green	4 = 21-50%
Total Vegetative Cover:	70%

Vegetation Type D:	
Length of transect in this type: feet	
Plant Species	**Cover**
Total Vegetative Cover:	%

MDT WETLAND MONITORING – VEGETATION TRANSECT

Site: **Little Muddy Wetland** Date: **August 3, 2009** Examiner: **A. Pipp**
Transect Number: **2** Approximate Transect Length: **310 feet** Compass Direction from Start: **266˚** Note: **Open water without a T2 end; declination at 16 deg.**

Vegetation Type E: **Type 6 - Kochia / Agropyron Upland**	
Length of transect in this type: 0-5 feet	
Plant Species	**Cover**
Elymus varnensis	+ = < 1%
Kochia scoparia (not seen in 2008-2009)	
Rumex maritimus	+ = < 1%
Agropyron intermedium	4 = 21-50%
Agropyron smithii	4 = 21-50%
Chenopodium album	+ = < 1%
Lactuca serriola (not seen in 2009)	
Polygonum douglasii	+ = < 1%
Total Vegetative Cover:	90%

Vegetation Type F: **Type 7 - Rumex maritimus**	
Length of transect in this type: 5-6* feet	
Plant Species	**Cover**
Rumex maritimus	2 = 6-10%
Hordeum jubatum	+ = < 1%
Kochia scoparia (not seen in 2008-2009)	
Polygonum aviculare (not seen in 2008-2009)	
Puccinellia nuttalliana (not seen in 2008-2009)	
Chenopodium album	+ = < 1%
Agropyron smithii	3 = 11-20%
Rumex crispus	2 = 6-10%
Chenopodium glaucum	+ = < 1%
* Width is actually 6 to 10 inches.	
Total Vegetative Cover:	45%

Vegetation Type G: **Type 8 - Algae / Aquatic Plant Wetland**	
Length of transect in this type: 6-310 feet	
Plant Species	**Cover**
Rumex maritimus (not seen in 2008-2009)	
Potamogeton pectinatus	4 = 21-50%
Polygonum aviculare (not seen in 2008-2009)	
Chenopodium glaucum (not seen in 2008-2009)	
Rorippa sinuata (not seen in 2008-2009)	
Alisma gramineum (not seen in 2009)	
algae, green	4 = 21-50%
Total Vegetative Cover:	40%

Vegetation Type H:	
Length of transect in this type: feet	
Plant Species	**Cover**
Total Vegetative Cover:	%

MDT WETLAND MONITORING – VEGETATION TRANSECT

Cover Estimate		**Indicator Class**	**Source**
+ = < 1%	3 = 11-10%	+ = Obligate	P = Planted
1 = 1-5%	4 = 21-50%	- = Facultative/Wet	V = Volunteer
2 = 6-10%	5 = > 50%	0 = Facultative	

Percent of perimeter developing wetland vegetation (excluding dam/berm structures): **90%**

Establish transects perpendicular to the shoreline (or saturated perimeter). The transect should begin in the upland area. Permanently mark this location with a standard metal fencepost. Extend the imaginary transect line towards the center of the wetland, ending at the 3 foot depth (in open water), or at the point where water depths or saturation are maximized. Mark this location with another metal fencepost.

Estimate cover within a 10 foot wide "belt" along the transect length. At a minimum, establish a transect at the windward and leeward sides of the wetland. Remember that the purpose of this sampling is to monitor, not inventory, representative portions of the wetland site.

Comments: _____

BIRD SURVEY – FIELD DATA SHEET

Site: **Little Muddy Wetland** Date: **6/1/09**
Survey Time: **11:30 am** to **2:00 pm**

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
American Avocet	2	F	MA				
American Coot	81	F	OW				
American Wigeon	9	F	OW				
Blackbird, Brewer's	4	L	MA				
Blackbird, Red-winged	7	FO F N	OW MA UP				
Blackbird, Yellow-headed	2	F L	MA				
Eared Grebe	17	L	OW				
Goose, Canada	7	F	OW				
Gull, Franklin's	30	F	OW UP				
Killdeer	5	L N F	MA UP				
Mallard	26	F N	OW MA				
Meadowlark, Western	2	L	UP				
Pharalope, Wilson's	10	F	OW				
Pintail, Northern	8	L	OW				
Redhead	2	L	OW MA				
Sandpiper (unknown sp.)	2	N	MA				
Shoveller, Northern	51	L FO	OW				
Sparrow (unknown sp.)	1	F	UP				
Teal, Blue-winged	8	F	OW				
Teal, Cinnamon	2	F	OW				
Teal, Green-winged	1	FO	OW				

BEHAVIOR CODES
BP = One of a breeding pair
BD = Breeding display
F = Foraging
FO = Flyover
L = Loafing
N = Nesting

HABITAT CODES
AB = Aquatic bed
FO = Forested
I = Island
MA = Marsh
MF = Mud Flat
OW = Open Water
SS = Scrub/Shrub
UP = Upland buffer
WM = Wet meadow
US = Unconsolidated shore

Weather: **Low 70's; 0-5 mnp winds; Blue sky with scattered clouds.**

Notes: **Site is 100% full or nearly so. Water is topping the overflow level. Water in site is fairly clear. Clumps of algae are present and scattered through site. Five short sections of bank in the northwest corner of site are actively sloughing. At the inlet, water is also pouring over the Sheetpile Diversion into Little Muddy Creek.**
Canada Geese goslings observed in site.
Many Horned Larks and Red-winged Blackbirds are present outside of site.

BIRD SURVEY – FIELD DATA SHEET

Site: **Little Muddy Wetland** Date: **8/3/09**
Survey Time: **9:00 am** to **7:00 pm**

Bird Species	#	Behavior	Habitat	Bird Species	#	Behavior	Habitat
Avocet, American	13	F L	MA				
Blackbird, Yellow-headed	4	F L	MA				
Common Snipe	2	L	UP				
Coot, American	10	F F	OW				
Cormorant, Double-crested	8	L F	MA OW				
Crane, Sandhill	5	F	MA UP				
Curlew, Long-billed	20	F L FO	OW MA				
Ducks (unknown sp.)	20	F	OW				
Goose, Canada	24	F L	OW MA				
Grebe, Eared	4	L F	OW				
Gull, California	5	F L FO	MA OW				
Gull, Franklin's	1	FO	MA				
Heron, Great Blue	3	F L	OW				
Mallard	6	F L	OW MA				
Pelican, American	25	F L	OW MA				
Redhead	>5	F L	OW MA				
Shorebirds (unid.)	50	F FO L	MA OW US				
Shoveller, Northern	20	F L	OW				
Swan, Tundra	3	L	OW				
Teal, Green-winged	3	L	OW				
Wigeon, Eurasian	3	L	OW				

BEHAVIOR CODES
BP = One of a breeding pair
BD = Breeding display
F = Foraging
FO = Flyover
L = Loafing
N = Nesting

HABITAT CODES
AB = Aquatic bed
FO = Forested
I = Island
MA = Marsh
MF = Mud Flat
OW = Open Water
SS = Scrub/Shrub
UP = Upland buffer
WM = Wet meadow
US = Unconsolidated shore

Weather: **Cloudy Sky; 70's (morning) to 80's (afternoon); 5-10 mph winds.**

Notes: **Bird observations are incomplete as this task was done incidental to vegetation monitoring and wetland delineation tasks. American Avocets, Mallards, Canada Geese, Eared Grebes, and Nothern Shovellers species were each observed with young.**

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 1

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area? (If needed, explain on the reverse side)	Yes (No)	**Field Location:** In outlet channel.

VEGETATION **(USFWS Region No. 9)**

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Rumex crispus	Herb	FACW	*Eleocharis palustris*	Herb	OBL
Dock,Curly			Spikerush,Creeping		
Typha latifolia	Herb	OBL	*Hordeum jubatum*	Herb	FAC+
Cattail,Broad-Leaf			Barley,Fox-Tail		

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 4/4 = 100.00%

FAC Neutral: 3/3 = 100.00%

Numeric Index: 7/4 = 1.75

Remarks:
Alisma gramineum is also near to pit.

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	= 0.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- NO **Drift Lines**
- NO **Sediment Deposits**
- NO **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- YES **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:
Inlet has from 0 to 5 inches of stagnant surface water.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 1

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes

Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**

Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)

Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-2	A	2.5Y4/2	N/A	N/A	N/A	Silty clay
2-12	A/B	2.5Y4/2	10YR5/6 2.5Y5/4	Few	Prominent	Silty clay

Hydric Soil Indicators:

- NO **Histosol**
- NO **Histic Epipedon**
- NO **Sulfidic Odor**
- NO **Aquic Moisture Regime**
- NO **Reducing Conditions**
- YES **Gleyed or Low Chroma Colors**
- NO **Concretions**
- NO **High Organic Content in Surface Layer in Sandy Soils**
- NO **Organic Streaking in Sandy Soils**
- NO **Listed on Local Hydric Soils List**
- NO **Listed on National Hydric Soils List**
- NO **Other (Explain in Remarks)**

Remarks:
The soil layer from 2-12 inches has two matrix colors of 70% 2.5Y 4/2 and 20% 10YR 4/1 with mottle colors of 10YR 5/6 (5%) and 2.5Y 5/4 (5%).

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland? (Yes) No
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 2

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		Wetland fringe on Transect 2.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Rumex maritimus	Herb	FACW+	*Chenopodium glaucum*	Herb	FAC
Dock,Golden			Goosefoot,Oakleaf		
Rumex crispus	Herb	FACW	*Agropyron smithii*	Herb	FACU
Dock,Curly			Wheatgrass,Western		

Percent of Dominant Species that are OBL, FACW or FAC:	**FAC Neutral:** 2/3 = 66.67%
(excluding FAC-) 3/4 = 75.00%	**Numeric Index:** 11/4 = 2.75

Remarks:
Vegetative strip is 6 to 10 inches wide on Transect 2.

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	= 2.0 *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	N/A *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- YES **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- NO **Drift Lines**
- NO **Sediment Deposits**
- NO **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- YES **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 2

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-0.5	Oi	10YR2/1	N/A	N/A	N/A	Mucky mineral
0.5-5	A	2.5Y5/3	N/A	N/A	N/A	Clay
5-14	B	2.5Y5/2	N/A	N/A	N/A	Clay

Hydric Soil Indicators:
- NO **Histosol**
- NO **Histic Epipedon**
- NO **Sulfidic Odor**
- NO **Aquic Moisture Regime**
- NO **Reducing Conditions**
- NO **Gleyed or Low Chroma Colors**
- NO **Concretions**
- NO **High Organic Content in Surface Layer in Sandy Soils**
- NO **Organic Streaking in Sandy Soils**
- NO **Listed on Local Hydric Soils List**
- NO **Listed on National Hydric Soils List**
- YES **Other (Explain in Remarks)**

Remarks:
Soils meet NRCS Hydric Soils criteria #3, "Soils that are frequently ponded for long duration or very long duration during the growing season."

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland?	(Yes) No
Wetland Hydrology Present?	(Yes) No		
Hydric Soils Present?	(Yes) No		

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 3

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		In wetland fringe on SE bank of site.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Rumex crispus	Herb	FACW	*Rumex maritimus*	Herb	FACW+
Dock,Curly			Dock,Golden		
Hordeum jubatum	Herb	FAC+	*Agropyron smithii*	Herb	FACU
Barley,Fox-Tail			Wheatgrass,Western		

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 3/4 = 75.00%

FAC Neutral: 2/3 = 66.67%

Numeric Index: 11/4 = 2.75

Remarks:
Wetland fringe is seven feet wide.

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	= 7.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- YES **Drift Lines**
- NO **Sediment Deposits**
- NO **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- YES **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 3

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-5	A	2.5Y4/1	N/A	N/A	N/A	Clay
5-14	B	2.5Y5/2	N/A	N/A	N/A	Clay

Hydric Soil Indicators:
- NO **Histosol**
- NO **Histic Epipedon**
- NO **Sulfidic Odor**
- NO **Aquic Moisture Regime**
- NO **Reducing Conditions**
- NO **Gleyed or Low Chroma Colors**
- NO **Concretions**
- NO **High Organic Content in Surface Layer in Sandy Soils**
- NO **Organic Streaking in Sandy Soils**
- NO **Listed on Local Hydric Soils List**
- NO **Listed on National Hydric Soils List**
- YES **Other (Explain in Remarks)**

Remarks:
Soil meet NRCS Hydric Soils criteria #3, "Soils that are frequently ponded for long duration or very long duration during the growing season."

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland?	(Yes) No
Wetland Hydrology Present?	(Yes) No		
Hydric Soils Present?	(Yes) No		

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 4

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		In Type 7 near Transect 1.

VEGETATION **(USFWS Region No. 9)**

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Rumex maritimus	Herb	FACW+	*Hordeum jubatum*	Herb	FAC+
Dock,Golden			Barley,Fox-Tail		
Potamogeton pectinatus	Herb	OBL			
Pondweed,Sago					

Percent of Dominant Species that are OBL, FACW or FAC: **FAC Neutral:** 2/2 = 100.00%
(excluding FAC-) 3/3 = 100.00% **Numeric Index:** 6/3 = 2.00

Remarks:
Also dominant was a species of green algae.

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	= 6.0 *(in.)*
Depth to Saturated Soil:	= 0.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- NO **Drift Lines**
- NO **Sediment Deposits**
- YES **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- YES **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:
Pit was dug on very edge of community where soil was not inundated. Soil was inundated just north of the pit (see photograph of soil pit).

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 4

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-1.5	Oi	10YR2/1	N/A	N/A	N/A	Mucky mineral
1.5-5.0	A	2.5Y5/1	N/A	N/A	N/A	Clay
5-14	B	2.5Y5/2	N/A	N/A	N/A	Clay

Hydric Soil Indicators:

NO **Histosol**	NO **Concretions**
NO **Histic Epipedon**	NO **High Organic Content in Surface Layer in Sandy Soils**
NO **Sulfidic Odor**	NO **Organic Streaking in Sandy Soils**
NO **Aquic Moisture Regime**	NO **Listed on Local Hydric Soils List**
NO **Reducing Conditions**	NO **Listed on National Hydric Soils List**
NO **Gleyed or Low Chroma Colors**	YES **Other (Explain in Remarks)**

Remarks:
Soil meets NRCS Hydric Soils criteria #3, "Soils that are frequently ponded for long duration or very long duration during the growing season."

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland?	(Yes) No
Wetland Hydrology Present?	(Yes) No		
Hydric Soils Present?	(Yes) No		

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 5

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		On peninsula.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Polygonum aviculare	Herb	FACW-	*Potamogeton pectinatus*	Herb	OBL
Knotweed,Prostrate			Pondweed,Sago		

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 2/2 = 100.00%	**FAC Neutral:** 2/2 = 100.00% **Numeric Index:** 3/2 = 1.50

Remarks:
The peninsula was being exposed as the surface waters evaporated. Green algae and the Potamogeton were dominant species, but were drying up in the sun. The dominant species on the peninsula, but not near the plot, were large patches of Rumex maritimus, Hordeum jubatum, Typha latifolia, and Rorippa sinuata.

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	= 4.0 *(in.)*
Depth to Saturated Soil:	= 0.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- NO **Drift Lines**
- NO **Sediment Deposits**
- NO **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- YES **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:
Soil was inundated about a feet from the soil pit. See notes under vegetation.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 5

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-1.5	Oi	10YR2/1	N/A	N/A	N/A	Mucky mineral
1.5-12	A/B	2.5Y4/2	N/A	N/A	N/A	Silty clay

Hydric Soil Indicators:

NO **Histosol**	NO **Concretions**
NO **Histic Epipedon**	NO **High Organic Content in Surface Layer in Sandy Soils**
NO **Sulfidic Odor**	NO **Organic Streaking in Sandy Soils**
NO **Aquic Moisture Regime**	NO **Listed on Local Hydric Soils List**
NO **Reducing Conditions**	NO **Listed on National Hydric Soils List**
NO **Gleyed or Low Chroma Colors**	YES **Other (Explain in Remarks)**

Remarks:
Soil meets NRCS Hydric Soils criteria #4, "Soils that are frequently flooded for long duration or very long duration during the growing season."

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	Is the Sampling Point within the Wetland? (Yes) No
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 6

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		In Type 11; SW area of site.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Hordeum jubatum	Herb	FAC+	*Iva axillaris*	Herb	FAC
Barley,Fox-Tail			Sumpweed,Small-Flower		
Agropyron smithii	Herb	FACU	*Rumex maritimus*	Herb	FACW+
Wheatgrass,Western			Dock,Golden		

Percent of Dominant Species that are OBL, FACW or FAC: **FAC Neutral:** 1/2 = 50.00%
(excluding FAC-) 3/4 = 75.00% **Numeric Index:** 12/4 = 3.00

Remarks:

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	= 7.0 *(in.)*
Depth to Saturated Soil:	= 0.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- NO **Drift Lines**
- NO **Sediment Deposits**
- NO **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- NO **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:

WetForm™

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 6

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-0.5	Oi	10YR2/1	N/A	N/A	N/A	Mucky mineral
0.5-5.0	A	2.5YR4/1	N/A	N/A	N/A	Silty clay
5-12	B	2.5YR4/1	N/A	N/A	N/A	Clay

Hydric Soil Indicators:

NO **Histosol**	NO **Concretions**
NO **Histic Epipedon**	NO **High Organic Content in Surface Layer in Sandy Soils**
NO **Sulfidic Odor**	NO **Organic Streaking in Sandy Soils**
NO **Aquic Moisture Regime**	NO **Listed on Local Hydric Soils List**
NO **Reducing Conditions**	NO **Listed on National Hydric Soils List**
YES **Gleyed or Low Chroma Colors**	NO **Other (Explain in Remarks)**

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland?	(Yes) No
Wetland Hydrology Present?	(Yes) No		
Hydric Soils Present?	(Yes) No		

Remarks:

WetForm™

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 7

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		In Type 10; West-Central area of site.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Typha latifolia	Herb	OBL			
Cattail,Broad-Leaf					

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 1/1 = 100.00%

FAC Neutral: 1/1 = 100.00%
Numeric Index: 1/1 = 1.00

Remarks:
Typha accounted for 80% of area. Agropyron smithii was present at 5% of area. Bare soil and surface water accounted for 15% of area.

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A Stream, Lake or Tide Gauge
- N/A Aerial Photographs
- N/A Other

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	= 2.0 *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	N/A *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- YES Inundated
- YES Saturated in Upper 12 Inches
- NO Water Marks
- NO Drift Lines
- NO Sediment Deposits
- NO Drainage Patterns in Wetlands

Secondary Indicators
- NO Oxidized Root Channels in Upper 12 Inches
- NO Water-Stained Leaves
- NO Local Soil Survey Data
- YES FAC-Neutral Test
- NO Other(Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 7

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-0.5	Oi	10YR2/1	N/A	N/A	N/A	Mucky mineral
0.5-12	A/B	2.5Y4/1	N/A	N/A	N/A	Clay

Hydric Soil Indicators:

NO Histosol	NO Concretions
NO Histic Epipedon	NO High Organic Content In Surface Layer In Sandy Soils
NO Sulfidic Odor	NO Organic Streaking in Sandy Soils
NO Aquic Moisture Regime	NO Listed on Local Hydric Soils List
NO Reducing Conditions	NO Listed on National Hydric Soils List
YES Gleyed or Low Chroma Colors	NO Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	Is the Sampling Point within the Wetland? (Yes) No
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 8

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area? (If needed, explain on the reverse side)	Yes (No)	**Field Location:** In Transitional area.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Bromus inermis	Herb	NI	*Typha latifolia*	Herb	OBL
Brome, smooth			Cattail,Broad-Leaf		
Agropyron smithii	Herb	FACU			
Wheatgrass,Western					

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 1/2 = 50.00%	**FAC Neutral:** 1/2 = 50.00% **Numeric Index:** 5/2 = 2.50

Remarks:
Bromus inermis (60%), Agropryon smithii (15%), Typha latifolia (10%), Rumex crispus (3%), Rumex maritimus (1%), and Hordeum jubatum (1%).

HYDROLOGY

NO Recorded Data(Describe in Remarks):
- N/A Stream, Lake or Tide Gauge
- N/A Aerial Photographs
- N/A Other

YES No Recorded Data

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	= 10.0 *(in.)*
Depth to Saturated Soil:	= 0.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO Inundated
- YES Saturated in Upper 12 Inches
- NO Water Marks
- NO Drift Lines
- NO Sediment Deposits
- NO Drainage Patterns in Wetlands

Secondary Indicators
- NO Oxidized Root Channels in Upper 12 Inches
- NO Water-Stained Leaves
- NO Local Soil Survey Data
- NO FAC-Neutral Test
- NO Other(Explain in Remarks)

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 8

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-6	A	2.5Y4/1	N/A	N/A	N/A	Clay
6-12	B	2.5Y4/2	N/A	N/A	N/A	Clay

Hydric Soil Indicators:

NO Histosol	NO Concretions
NO Histic Epipedon	NO High Organic Content in Surface Layer in Sandy Soils
NO Sulfidic Odor	NO Organic Streaking in Sandy Soils
NO Aquic Moisture Regime	NO Listed on Local Hydric Soils List
NO Reducing Conditions	NO Listed on National Hydric Soils List
NO Gleyed or Low Chroma Colors	NO Other (Explain in Remarks)

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes (No)	Is the Sampling Point within the Wetland? Yes (No)
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	Yes (No)	

Remarks:
Area is inundated upland based on vegetation and soils.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 9

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** Emergent
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		In Type 14.

VEGETATION (USFWS Region No. 9)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator
Rumex crispus	Herb	FACW	*Iva axillaris*	Herb	FAC
Dock,Curly			Sumpweed,Small-Flower		
Hordeum jubatum	Herb	FAC+			
Barley,Fox-Tail					

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 3/3 = 100.00%
FAC Neutral: 1/1 = 100.00%
Numeric Index: 8/3 = 2.67

Remarks:

HYDROLOGY

NO **Recorded Data(Describe in Remarks):**
- N/A **Stream, Lake or Tide Gauge**
- N/A **Aerial Photographs**
- N/A **Other**

YES **No Recorded Data**

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	= 0.0 *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO **Inundated**
- YES **Saturated in Upper 12 Inches**
- NO **Water Marks**
- NO **Drift Lines**
- NO **Sediment Deposits**
- NO **Drainage Patterns in Wetlands**

Secondary Indicators
- NO **Oxidized Root Channels in Upper 12 Inches**
- NO **Water-Stained Leaves**
- NO **Local Soil Survey Data**
- YES **FAC-Neutral Test**
- NO **Other(Explain in Remarks)**

Remarks:

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Little Muddy Creek Wetland Mitigation Site-2009	**Project No:** 0B4308802	**Date:** 3-Aug-2009
Applicant/Owner:	Ducks Unlimited / MDT		**County:** Cascade
Investigators:	andrea pipp		**State:** Montana
			Plot ID: Soil Pit 9

SOILS

Map Unit Name (Series and Phase): Absher-Noble Complex, 0-5% slopes
Map Symbol: 10 **Drainage Class:** moderately well drained **Mapped Hydric Inclusion?**
Taxonomy (Subgroup): Fine montmorillonitic Borollic Natragid **Field Observations Confirm Mapped Type?** Yes (No)
Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast		Texture, Concretions, Structure, etc
0-12	A	2.5Y4/1	N/A	N/A	N/A	Clay

Hydric Soil Indicators:
- NO **Histosol**
- NO **Histic Epipedon**
- NO **Sulfidic Odor**
- NO **Aquic Moisture Regime**
- NO **Reducing Conditions**
- YES **Gleyed or Low Chroma Colors**
- NO **Concretions**
- NO **High Organic Content in Surface Layer in Sandy Soils**
- NO **Organic Streaking in Sandy Soils**
- NO **Listed on Local Hydric Soils List**
- NO **Listed on National Hydric Soils List**
- NO **Other (Explain in Remarks)**

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	Is the Sampling Point within the Wetland?	(Yes) No
Wetland Hydrology Present?	(Yes) No		
Hydric Soils Present?	(Yes) No		

Remarks:

MDT MONTANA WETLAND ASSESSMENT FORM (revised March 2008)

1. Project Name: Little Muddy Creek Wetland Mitigation Site **2. MDT Project #:** STPX 7(38) **3. Control #:** 5033

3. Evaluation Date: August 3, 2009 **4. Evaluator(s):** Andrea Pipp **5. Wetland/Site #(s):** Entire Little Muddy Creek Site

6. Wetland Location(s): Township 19 N, Range 1 E, Section 31, 31, 32; Township ___ N, Range ___ E, Section _____

Approximate Stationing or Roadposts: _____

Watershed: 7 - Missouri - Sun - Smith **County:** Cascade _ _ _____

7. Evaluating Agency: MDT

Purpose of Evaluation:

- ☐ **Wetland potentially affected by MDT project**
- ☐ **Mitigation wetlands; pre-construction**
- ☒ **Mitigation wetlands; post-construction**
- ☐ **Other** _____

8. Wetland Size (acre): _____ (visually estimated)
162.82 (measured, e.g. GPS)

9. Assessment Area (AA) Size (acre): _____ (visually estimated)
(see manual for determining AA) 189.81 (measured, e.g. GPS)

10. CLASSIFICATION OF WETLAND AND AQUATIC HABITATS IN AA (See manual for definitions.)

HGM Class (Brinson)	Class (Cowardin)	Modifier (Cowardin)	Water Regime	% OF AA
Riverine	Aquatic Bed	Impounded	Permanent / Perennial	62
Riverine	Emergent Wetland	Impounded	Seasonal / Intermittent	23
Riverine	Unconsolidated Bottom	Impounded	Permanent / Perennial	14
Riverine	Unconsolidated Shore	Impounded	Seasonal / Intermittent	1

Comments: Site is also excavated, particularly to create the inlet channel and berm (Modifier from Cowardin).

11. ESTIMATED RELATIVE ABUNDANCE (of similarly classified sites within the same Major Montana Watershed Basin; see manual.)
rare

12. GENERAL CONDITION OF AA

i. Disturbance: Use matrix below to select the appropriate response; see manual for Montana listed noxious weed and aquatic nuisance vegetation species lists.

Conditions within AA	Predominant Conditions Adjacent to (within 500 feet of) AA		
	Managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings; and noxious weed or ANVS cover is ≤15%.	Land not cultivated, but may be moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings; noxious weed or ANVS cover is ≤30%.	Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density; or noxious weed or ANVS cover is >30%.
AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings; and noxious weed or ANVS cover is ≤15%.	low disturbance	---	---
AA not cultivated, but may be moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings; noxious weed or ANVS cover is ≤30%.	---	---	---
AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density; or noxious weed or ANVS cover is >30%.	---	---	---

Comments (types of disturbance, intensity, season, etc.)**:** AA is now managed for wildlife habitat. Adjacent to AA are fields in CRP.

ii. Prominent noxious, aquatic nuisance, and other exotic vegetation species: Cirsium arvense, Kochia scoparia, Bromus japonicus, Sisymbrium altissimum.

iii. Provide brief descriptive summary of AA and surrounding land use/habitat: AA has been excavated, impounded, and flooded to pond water for waterfowl habitat. Surrounding land was cultivated crops that are now in CRP.

13. STRUCTURAL DIVERSITY (Based on number of "Cowardin" ***vegetated*** classes present [do not include unvegetated classes]; see #10 above.)

Existing # of "Cowardin" Vegetated Classes in AA	Initial Rating	Is current management preventing (passive) existence of additional vegetated classes?		Modified Rating
≥3 (or 2 if one is forested) classes	---	NA	NA	NA
2 (or 1 if forested) classes	mod	NA	NA	NA
1 class, but not a monoculture	---	←NO	YES→	---
1 class, monoculture (1 species comprises ≥90% of total cover)	---	NA	NA	NA

Comments: _____

Wetland/Site #(s): Entire Little Muddy Creek Site

14A. HABITAT FOR FEDERALLY LISTED OR PROPOSED THREATENED OR ENDANGERED PLANTS OR ANIMALS

i. AA is Documented (D) or Suspected (S) to contain: Check box based on definitions in manual.

Primary or critical habitat (**list species**) ☐ D ☐ S _____
Secondary habitat (**list species**) ☐ D ☐ S _____
Incidental habitat (**list species**) ☐ D ☐ S _____
No usable habitat ☒ S

ii. Rating: Based on the strongest habitat chosen in 14A(i) above, select the corresponding functional point and rating.

Highest Habitat Level	Doc/Primary	Sus/Primary	Doc/Secondary	Sus/Secondary	Doc/Incidental	Sus/Incidental	None
Functional Point/Rating	---	---	---	---	---	---	0L

Sources for documented use (e.g. observations, records): _____

14B. HABITAT FOR PLANTS OR ANIMALS RATED S1, S2, OR S3 BY THE MONTANA NATURAL HERITAGE PROGRAM
Do not include species listed in 14A above.

i. AA is Documented (D) or Suspected (S) to contain: Check box based on definitions in manual.

Primary or critical habitat (**list species**) ☐ D ☐ S _____
Secondary habitat (**list species**) ☒ D ☐ S Bald Eagle
Incidental habitat (**list species**) ☒ D ☐ S Ferruginous Hawk and Trumpeter Swan.
No usable habitat ☐ S

ii. Rating: Based on the strongest habitat chosen in 14A(i) above, select the corresponding functional point and rating.

Highest Habitat Level	Doc/Primary	Sus/Primary	Doc/Secondary	Sus/Secondary	Doc/Incidental	Sus/Incidental	None
S1 Species Functional Point/Rating	---	---	---	---	---	---	---
S2 and S3 Species Functional Point/Rating	---	---	.6M	---	---	---	---

Sources for documented use (e.g. observations, records): Bald Eagle: Observed by Landowner in 2006; four documented nests occur within a 5-mile radius (MTNHP 2002). Ferruginous Hawk: Observed by PBS&J in 2006. Trumpeter Swan: Observed by PBS&J and MDT in 2007.

14C. GENERAL WILDLIFE HABITAT RATING

i. Evidence of Overall Wildlife Use in the AA: Check substantial, moderate, or low based on supporting evidence.

☒ ***Substantial:*** Based on any of the following [check].
- ☒ observations of abundant wildlife #s or high species diversity (during any period)
- ☒ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☒ presence of extremely limiting habitat features not available in the surrounding area
- ☐ interview with local biologist with knowledge of the AA

☐ ***Minimal:*** Based on any of the following [check].
- ☐ few or no wildlife observations during peak use periods
- ☐ little to no wildlife sign
- ☐ sparse adjacent upland food sources
- ☐ interview with local biologist with knowledge of AA

☐ ***Moderate:*** Based on any of the following [check].
- ☐ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- ☐ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- ☐ adequate adjacent upland food sources
- ☐ interview with local biologist with knowledge of the AA

ii. Wildlife Habitat Features: Working from top to bottom, check appropriate AA attributes in matrix to arrive at rating. Structural diversity is from #13. For class cover to be considered evenly distributed, the most and least prevalent **vegetated** classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see manual for further definitions of these terms].

Structural Diversity (see #13)	☐ **High**								☒ **Moderate**								☐ **Low**			
Class Cover Distribution (all vegetated classes)	☐ **Even**				☐ **Uneven**				☒ **Even**				☐ **Uneven**				☐ **Even**			
Duration of Surface Water in ≥ 10% of AA	**P/P**	**S/I**	**T/E**	**A**	**P/P**	**S/I**	**T/E**	**A**	**P/P**	**S/I**	**T/E**	**A**	**P/P**	**S/I**	**T/E**	**A**	**P/P**	**S/I**	**T/E**	**A**
☒ **Low Disturbance** at AA (see #12i)	---	---	---	---	---	---	---	---	E	---	---	---	---	---	---	---	---	---	---	---
☐ **Moderate Disturbance** at AA (see #12i)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
☐ **High Disturbance** at AA (see #12i)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

iii. Rating: Use the conclusions from i and ii above and the matrix below to select the functional point and rating.

Evidence of Wildlife Use (i)	**Wildlife Habitat Features Rating (ii)**			
	☒ **Exceptional**	☐ **High**	☐ **Moderate**	☐ **Low**
☒ **Substantial**	1E	---	---	---
☐ **Moderate**	---	---	---	---
☐ **Minimal**	---	---	---	---

Comments: High diversity and abundance of bird species throughout year. High ungulate diversity and abundance. Many wildlife trails.

Wetland/Site #(s): Entire Little Muddy Creek Site

14D. GENERAL FISH HABITAT ☐ **NA** (proceed to 14E)

If the AA is not used by fish, fish use is not restorable due to habitat constraints, or is not desired from a management perspective [such as fish entrapped in a canal], then check the NA box and proceed to 14E.

Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier].

Type of Fishery: ☐ Cold Water (**CW**) ☒ Warm Water (**WW**) **Use the CW or WW guidelines in the manual to complete the matrix.**

i. Habitat Quality and Known / Suspected Fish Species in AA: Use matrix to select the functional point and rating.

Duration of Surface Water in AA	☒ **Permanent / Perennial**						☐ **Seasonal / Intermittent**						☐ **Temporary / Ephemeral**					
Aquatic Hiding / Resting / Escape Cover	☐ **Optimal**		☐ **Adequate**		☒ **Poor**		☐ **Optimal**		☐ **Adequate**		☐ **Poor**		☐ **Optimal**		☐ **Adequate**		☐ **Poor**	
Thermal Cover: optimal / suboptimal	**O**	**S**	**O**	**S**	**O**	**S**	**O**	**S**	**O**	**S**	**O**	**S**	**O**	**S**	**O**	**S**	**O**	**S**
FWP Tier I fish species	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FWP Tier II or **Native Game** fish species	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FWP Tier III or **Introduced Game** fish	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FWP Non-Game Tier IV or **No** fish species	---	---	---	---	---	.3L	---	---	---	---	---	---	---	---	---	---	---	---

Sources used for identifying fish spp. potentially found in AA: Common carp were observed in 2002 within Little Muddy Creek and in 2007 and 2009 within the mitigation site. It was assumed that carp are present each year within the mitigation site.

ii. Modified Rating: NOTE: Modified score cannot exceed 1.0 or be less than 0.1.

a) Is fish use of the AA significantly reduced by a culvert, dike, or other man-made structure or activity, ***or*** *is the waterbody included on the current final MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support,* ***or*** *do aquatic nuisance plant or animal species (see* ***Appendix E****) occur in fish habitat?* ☒ **YES**, reduce score in **i** by 0.1 = 0.20 or ☐ **N0**

b) Does the AA contain a documented spawning area or other critical habitat feature (i.e., sanctuary pool, upwelling area; specify in comments) for native fish or introduced game fish? ☐ **YES**, add to score in **i** or **iia** 0.1 = __ or ☒ **N0**

iii. Final Score and Rating: .2L **Comments:** Fish probably breed, but spawning habitat has not been documented.

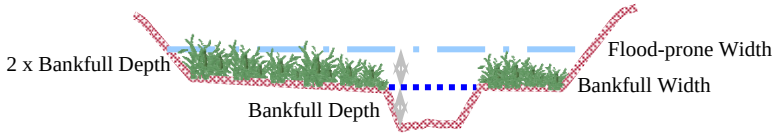
14E. FLOOD ATTENUATION ☐ **NA** (proceed to 14F)

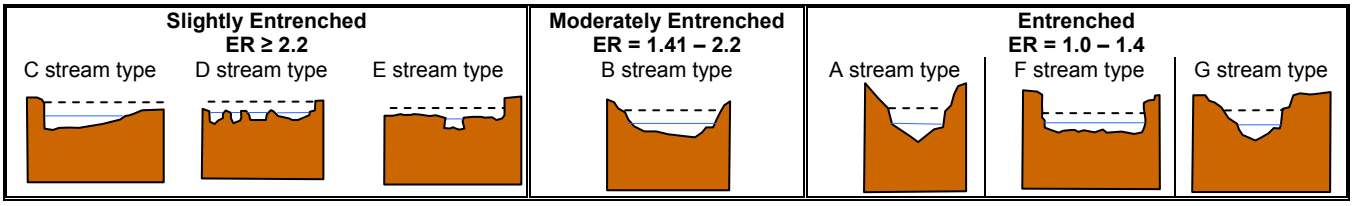
Applies only to wetlands that are subject to flooding via in-channel or overbank flow.
If wetlands in AA are not flooded from in-channel or overbank flow, check the NA box and proceed to 14F.

Entrenchment Ratio (ER) Estimation (see manual for additional guidance). Entrenchment ratio = (flood-prone width) / (bankfull width).
Flood-prone width = estimated horizontal projection of where 2 X maximum bankfull depth elevation intersects the floodplain on each side of the stream.

_____ / _____ = _____

flood prone width / bankfull width = entrenchment ratio





i. Rating: Working from top to bottom, use the matrix below to select the functional point and rating.

Estimated or Calculated Entrenchment (Rosgen 1994, 1996)	☒ Slightly Entrenched C, D, E stream types			☐ Moderately Entrenched B stream type			☐ Entrenched A, F, G stream types		
Percent of Flooded Wetland Classified as Forested and/or Scrub/Shrub	☐ 75%	☐ 25-75%	☒ <25%	☐ 75%	☐ 25-75%	☐ <25%	☐ 75%	☐ 25-75%	☐ <25%
AA contains **no outlet or restricted outlet**	---	---	.6M	---	---	---	---	---	---
AA contains **unrestricted outlet**	---	---	---	---	---	---	---	---	---

ii. Are ≥10 acres of wetland in the AA subject to flooding AND are man-made features which may be significantly damaged by floods located within 0.5 mile downstream of the AA? ☒ YES ☐ NO **Comments:** Site is filled during spring high runoff and during precip events.

Wetland/Site #(s): Entire Little Muddy Creek Site

14F. SHORT AND LONG TERM SURFACE WATER STORAGE ☐ **NA** (proceed to 14G)

Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, then check the NA box and proceed to 14G.

i. Rating: Working from top to bottom, use the matrix below to select the functional point and rating. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see manual for further definitions of these terms].

Estimated Maximum Acre Feet of Water Contained in Wetlands within the AA that are Subject to Periodic Flooding or Ponding	☒ **>5 acre feet**			☐ **1.1 to 5 acre feet**			☐ **≤1 acre foot**		
Duration of Surface Water at Wetlands within the AA	☒ **P/P**	☐ **S/I**	☐ **T/E**	☐ **P/P**	☐ **S/I**	☐ **T/E**	☐ **P/P**	☐ **S/I**	☐ **T/E**
Wetlands in AA flood or pond **≥ 5 out of 10 years**	1H	---	---	---	---	---	---	---	---
Wetlands in AA flood or pond **< 5 out of 10 years**	---	---	---	---	---	---	---	---	---

Comments: _____

14G. SEDIMENT / NUTRIENT / TOXICANT / RETENTION AND REMOVAL ☐ **NA** (proceed to 14H)

Applies to wetland with potential to receive sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, check the NA box and proceed to 14H.

i. Rating: Working from top to bottom, use the matrix below to select the functional point and rating.

Sediment, Nutrient, and Toxicant Input Levels within AA	**AA receives or surrounding land use has potential to deliver sediments, nutrients, or compounds at levels such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.**				**Waterbody is on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants or AA receives or surrounding land use has potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present.**			
% Cover of Wetland Vegetation in AA	☒ **≥ 70%**		☐ **< 70%**		☐ **≥ 70%**		☐ **< 70%**	
Evidence of Flooding / Ponding in AA	☒ **Yes**	☐ **No**	☐ **Yes**	☐ **No**	☐ **Yes**	☐ **No**	☐ **Yes**	☐ **No**
AA contains **no or restricted outlet**	1H	---	---	---	---	---	---	---
AA contains **unrestricted outlet**	---	---	---	---	---	---	---	---

Comments: _____

14H. SEDIMENT / SHORELINE STABILIZATION ☐ **NA** (proceed to 14I)

Applies only if AA occurs on or within the banks of a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action.
If 14H does not apply, check the NA box and proceed to 14I.

% Cover of Wetland Streambank or Shoreline by Species with Stability Ratings of ≥6 (see Appendix F).	**Duration of Surface Water Adjacent to Rooted Vegetation**		
	☒ **Permanent / Perennial**	☐ **Seasonal / Intermittent**	☐ **Temporary / Ephemeral**
☐ **≥ 65%**	---	---	---
☐ **35-64%**	---	---	---
☒ **< 35%**	.3L	---	---

Comments: Some erosion occuring along dike in NE portion of site.

14I. PRODUCTION EXPORT / FOOD CHAIN SUPPORT

i. Level of Biological Activity: Synthesis of wildlife and fish habitat rates (select).

General Fish Habitat Rating (14Diii)	**General Wildlife Habitat Rating (14Ciii)**		
	☒ **E/H**	☐ **M**	☐ **L**
☐ **E/H**	---	---	---
☐ **M**	---	---	---
☒ **L**	M	---	---
☐ **NA**	---	---	---

ii. Rating: Working from top to bottom, use the matrix below to select the functional point and rating. Factor A = acreage of vegetated wetland component in the AA; Factor B = level of biological activity rating from above (14Ii); Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to the duration of surface water in the AA, where P/P, S/I, and T/E were previously defined, and A = "absent" [see manual for further definitions of these terms].

A	☒ **Vegetated Component >5 acres**						☐ **Vegetated Component 1-5 acres**						☐ **Vegetated Component <1 acre**					
B	☐ **High**		☒ **Moderate**		☐ **Low**		☐ **High**		☐ **Moderate**		☐ **Low**		☐ **High**		☐ **Moderate**		☐ **Low**	
C	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
P/P	---	---	.8H	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S/I	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
T/E/A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Wetland/Site #(s): Entire Little Muddy Creek Site

14I. PRODUCTION EXPORT / FOOD CHAIN SUPPORT (continued)

iii. Modified Rating: Note: Modified score cannot exceed 1.0 or be less than 0.1.

Vegetated Upland Buffer: Area with ≥ 30% plant cover, ≤ 15% noxious weed or ANVS cover, AND that is not subjected to periodic mechanical mowing or clearing (unless for weed control).
Is there an average ≥ 50-foot wide vegetated upland buffer around ≥ 75% of the AA's perimeter? ☒ **YES**, add 0.1 to score in **ii** = 0.90 ☐ **NO**

iv. Final Score and Rating: .9H **Comments:** _____

14J. GROUNDWATER DISCHARGE / RECHARGE
Check the appropriate indicators in i and ii below.

i. Discharge Indicators
- ☐ The AA is a slope wetland.
- ☐ Springs or seeps are known or observed.
- ☐ Vegetation growing during dormant season/drought.
- ☐ Wetland occurs at the toe of a natural slope.
- ☐ Seeps are present at the wetland edge.
- ☐ AA permanently flooded during drought periods.
- ☐ Wetland contains an outlet, but no inlet.
- ☐ Shallow water table and the site is saturated to the surface.
- ☐ Other: _____

ii. Recharge Indicators
- ☐ Permeable substrate present without underlying impeding layer.
- ☐ Wetland contains inlet but no outlet.
- ☐ Stream is a known 'losing' stream. Discharge volume decreases.
- ☐ Other: _____

iii. Rating: Use the information from i and ii above and the table below to select the functional point and rating.

Criteria	Duration of Saturation at AA Wetlands ***FROM GROUNDWATER DISCHARGE*** or ***WITH WATER THAT IS RECHARGING THE GROUNDWATER SYSTEM*** ☐ P/P	☐ S/I	☐ T	☒ None
☒ **Groundwater Discharge or Recharge**	---	---	---	.1L
☐ **Insufficient Data/Information**	---			

Comments: _____

14K. UNIQUENESS

i. Rating: Working from top to bottom, use the matrix below to select the functional point and rating.

Replacement Potential	**AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland** OR **plant association listed as "S1" by the MTNHP**			**AA does not contain previously cited rare types** AND **structural diversity (#13) is high** OR **contains plant association listed as "S2" by the MTNHP**			**AA does not contain previously cited rare types** OR **associations** AND **structural diversity (#13) is low-moderate**		
Estimated Relative Abundance (#11)	☐ Rare	☐ Common	☐ Abundant	☐ Rare	☐ Common	☐ Abundant	☐ Rare	☒ Common	☐ Abundant
☒ **Low Disturbance** at AA (#12i)	---	---	---	---	---	---	---	.4M	---
☐ **Moderate Disturbance** at AA (#12i)	---	---	---	---	---	---	---	---	---
☐ **High Disturbance** at AA (#12i)	---	---	---	---	---	---	---	---	---

Comments: _____

14L. RECREATION / EDUCATION POTENTIAL ☐ NA (proceed to Overall Summary and Rating page)
Affords 'bonus' points if AA provides a recreational or educational opportunity.

i. Is the AA a known or potential recreational or educational site? ☒ **YES**, go to ii. ☐ **NO**, check the NA box.

ii. Check categories that apply to the AA: ☐ Educational/Scientific Study ☒ Consumptive Recreational ☒ Non-consumptive recreational
☐ Other: _____

iii. Rating: Use the matrix below to select the functional point and rating.

Known or Potential Recreational or Educational Area	Known	Potential
Public ownership or public easement with general public access (no permission required)	---	---
Private ownership with general public access (no permission required)	---	---
Private or public ownership without general public access, or requiring permission for public access	.1M	---

Comments: Mitigation site is used for hunting when permission is granted.

15. GENERAL SITE NOTES: _____

Wetland/Site #(s): Entire Little Muddy Creek Site

Function & Value Variables	Rating – Actual Functional Points	Possible Functional Points	Functional Units: Actual Points x Estimated AA Acreage	Indicate the Four Most Prominent Functions with an Asterisk
A. Listed / Proposed T&E Species Habitat	low 0.00	1.00		
B. MT Natural Heritage Program Species Habitat	mod 0.60	1.00		
C. General Wildlife Habitat	exc 1.00	1.00		*
D. General Fish Habitat	low 0.20	1.00		
E. Flood Attenuation	mod 0.60	1.00		
F. Short and Long Term Surface Water Storage	high 1.00	1.00		*
G. Sediment / Nutrient / Toxicant Removal	high 1.00	1.00		
H. Sediment / Shoreline Stabilization	low 0.30	1.00		
I. Production Export / Food Chain Support	high 0.90	1.00		*
J. Groundwater Discharge / Recharge	low 0.10	1.00		
K. Uniqueness	mod 0.40	1.00		*
L. Recreation / Education Potential (bonus point)	mod 0.10			
Total Points	**6.2**	**11.0**	**Total Functional Units**	
Percent of Possible Score 56% (round to nearest whole number)				

Category I Wetland: (must satisfy **one** of the following criteria; otherwise go to Category II)
- ☐ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
- ☐ Score of 1 functional point for Uniqueness; **or**
- ☐ Score of 1 functional point for Flood Attenuation **and** answer to Question 14E.ii is "yes"; **or**
- ☐ Percent of possible score > 80% (round to nearest whole #).

Category II Wetland: (Criteria for Category I not satisfied **and** meets any **one** of the following criteria; otherwise go to Category IV)
- ☐ Score of 1 functional point for MT Natural Heritage Program Species Habitat; **or**
- ☒ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
- ☐ Score of .9 or 1 functional point for General Fish Habitat; **or**
- ☐ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish/Aquatic Habitat; **or**
- ☐ Score of .9 functional point for Uniqueness; **or**
- ☐ Percent of possible score > 65% (round to nearest whole #).

☐ **Category III Wetland:** (Criteria for Categories I, II, or IV not satisfied)

Category IV Wetland: (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if not go to Category III)
- ☐ "Low" rating for Uniqueness; **and**
- ☐ Vegetated wetland component < 1 acre (do not include upland vegetated buffer); **and**
- ☐ Percent of possible score < 35% (round to nearest whole #).

OVERALL ANALYSIS AREA (AA) RATING: Check the appropriate category based on the criteria outlined above.

☐ **I** ☒ **II** ☐ **III** ☐ **IV**

Appendix C

2009 REPRESENTATIVE PHOTOGRAPHS

MDT Wetland Mitigation Monitoring
Little Muddy Creek
Cascade County, Montana

LITTLE MUDDY WETLAND MITIGATION SITE 2009



Photo 1: At Photo Point 1 facing 136˚ southeast.



Photo 2: At Photo Point 1 facing 210˚ southwest.



Photo 3: View is behind Photo Point 1at 40˚ northeast. Photo is of the outlet colonized by Type 12-*Alisma* wetland.



Photo 4: At Photo Point 2 facing 180˚ south.



Photo 5: At Photo Point 3 facing 130˚ southeast at the inlet channel and the Type 7-*Rumex* wetland fringe.



Photo 6: At Photo Point 4 facing 71˚ east at the inlet control structure with the diversion structure in background.



Photo 7: At Photo Point 4 facing the inlet at 208˚ southwest. Inlet has a Type 7-*Rumex* wetland fringe.



Photo 8: At Photo Point 6 facing 317˚ northwest with Square Butte in the background.



Photo 9: At Photo Point 5 facing 316˚ north.



Photo 10: View is facing 10˚ north from the start of Transect 1.



Photo 11: View is facing 266˚ west from the start of Transect 2.



Photo 12: View is south at Soil Pit 1 in Type 12-*Alisma* Wetland.



Photo 13: View is north at Soil Pit 2 in the very narrow Type 7-*Rumex* Wetland Fringe near Transect 2.



Photo 14: View is east at Soil Pit 3 in the Type 7-*Rumex* Wetland Fringe.



Photo 15: View is east at Soil Pit 4 in the Type 7-*Rumex* Wetland Fringe of Transect 1.



Photo 16: View is east at the peninsula and at the macroinvertebrate sampling site (arrow).



Photo 17: View is northeast, on the peninsula, and at Soil Pit 5 in Type 9/11 - *Hordeum* / *Polygonum* Wetland

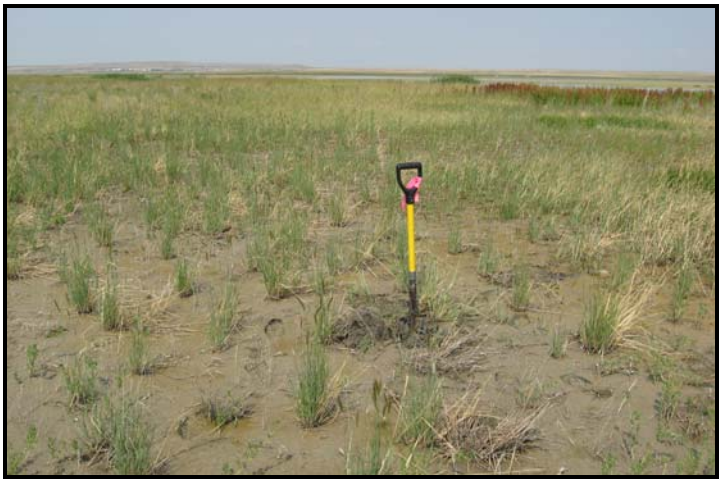


Photo 18: View is northeast at Soil Pit 6 in Type 11-*Hordeum jubatum* Wetland.



Photo 19: View is north at Soil Pit 7 in Type 10-*Typha latifolia* Wetland.



Photo 20: View is northwest at Soil Pit 8 in saturated upland.



Photo 21: View is north at Soil Pit 9 in Type 14-*Rumex* / *Eleocharis* Wetland.

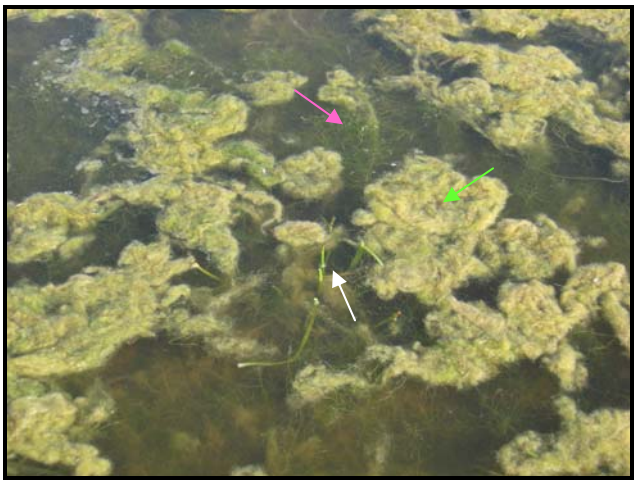


Photo 22: Type 8-Algae (green arrow), *Alisma* (white arrow), and *Potamogeton* (pink arrow).



Photo 23: View is northwest at a developing wetland with ducks, pelicans, willows, smartweed, cattail, and water.



Photo 24: View is north at Type 14-*Rumex* / *Eleocharis*.



Photo 25: View is east at a patch of Canada thistle mixed in with smartweed (*Rumex maritimus*).



Photo 26: View is west at a patch of Canada thistle mixed in with upland grasses.



Photo 27: View is west at eroding bank 1 along the north shore.



Photo 28: View is west at eroding banks 2 and 3 along the north shore.



Photo 29: View is west at eroding bank 4 along the north shoreline.



Photo 30: View is north at eroding banks 5 and 6 along the east shoreline.

Appendix D

PROJECT PLAN SHEET

MDT Wetland Mitigation Monitoring
Little Muddy Creek
Cascade County, Montana

PT	UTM U.S. FT. NORTH	EAST
1	17,206,802.93	1,479,211.74
2	17,206,824.09	1,479,186.24
3	17,207,087.31	1,479,566.03
4	17,208,211.15	1,479,827.45
5	17,208,211.15	1,479,315.48
6	17,209,777.74	1,479,315.49
7	17,209,777.74	1,480,148.29
8	17,210,102.92	1,480,302.56
9	17,210,878.86	1,478,550.35
10	17,212,252.48	1,477,267.61
11	17,212,307.25	1,477,184.31
12	17,212,550.94	1,477,137.32
13	17,212,746.02	1,477,182.38
14	17,212,971.41	1,477,278.90
15	17,213,023.25	1,477,338.50
16	17,213,177.52	1,477,751.03
17	17,213,152.97	1,477,796.21
18	17,213,041.30	1,477,730.02
19	17,213,080.43	1,477,895.22
20	17,212,944.10	1,477,365.42
21	17,212,712.19	1,477,266.74
22	17,212,361.56	1,477,265.48
23	17,212,321.77	1,477,326.05
24	17,210,948.45	1,478,514.35
25	17,210,685.53	1,479,318.72
26	17,210,498.84	1,479,714.77
27	17,209,818.89	1,481,718.34
28	17,209,301.53	1,483,119.54
29	17,209,252.84	1,484,062.10
30	17,209,833.31	1,484,063.44
31	17,209,827.70	1,484,152.56
32	17,209,249.76	1,484,123.82
33	17,209,240.83	1,484,296.98
34	17,209,003.66	1,484,314.61
35	17,207,988.54	1,484,320.98
36	17,207,933.46	1,484,135.62
37	17,207,807.48	1,482,747.38
38	17,207,138.83	1,480,886.36

HORIZONTAL CONTROL - IS MONTANA UTM ZONE 12 COORDINATES DESCRIBED IN FEET AND CALIBRATED TO USCGS TRIANGULATION STATION STAMPED "MUDDY CREEK NEAR,1949". THIS IS A FIRST ORDER CONTROL POINT FROM GPS INFORMATION TAKEN WITH TRIMBLE 4400 GPS RECEIVERS ON NOVEMBER 30, 1999 FROM WGS84 ELLIPSOID.

VERTICAL CONTROL - WAS CALIBRATED FROM GPS INFORMATION TO USCGS BENCH MARK "DE38 1961" WHICH IS A SECOND ORDER CLASS 0 BENCH MARK WITH A PUBLISHED ELEVATION OF 3465.82 FEET ON THE NAVD 88.

DUCKS UNLIMITED INC.
GREAT PLAINS REGIONAL OFFICE

PROJECT NO. MT-0192-001
LITTLE MUDDY WETLAND
PROJECT TOPOGRAPHY
CONSTRUCTION FEATURES
DATE: 6-27-2000
SHEET NO. 2 OF 10

DESIGNED BY: R.C.S.
DRAWN BY: K TSP
SURVEYED BY: G.L.J.
CHECKED BY: JRK
APPROVED BY:
APPROVED BY:

Appendix E

BIRD SURVEY PROTOCOL
GPS PROTOCOL

MDT Wetland Mitigation Monitoring
Little Muddy Creek
Cascade County, Montana

BIRD SURVEY PROTOCOL

This protocol was developed by the Montana Department of Transportation (MDT) to monitor bird use within their Wetland Mitigation Sites. Though each wetland mitigation site is vastly different, the bird survey data collection methods were standardized to order to increase repeatability. The protocol uses an "area search within a restricted time frame" to collect data on bird species, density, behavior, and habitat-type use.

Survey Area

Sites that can be entirely walked: Sites where the entire perimeter or area can be walked include, but are not limited to: small ponds, enhanced historic river channels, and wet meadows. If the wetland is not uncomfortably inundated, walk several meandering transects to sufficiently cover the wetland. Meandering transects can be used, even if a small portion of the area is inaccessible (e.g. cannot cross due to inundation). Use binoculars to identify the bird species, to count the number of individuals, and to identify their behavior and habitat type. Data can be recorded directly onto the bird survey form or into a field notebook. The number of meandering transects and their direction (or location) should be recorded in the field notebook and/or drawn onto the aerial photograph or topographic map. Meandering transects are not formal and should not be staked. Each site should be walked and surveyed to the fullest extent within the set time limit.

Sites than cannot be entirely walked: Sites where the entire perimeter or area cannot be walked include, but are not limited to: very large sites (i.e. perimeter of 2-3 miles), and large-bodied waters (i.e. reservoirs), where deep water habitat (> 6 feet) is close to shore. For large-bodied waters where only one area was graded to create or enhance the development of wetland, bird surveys should be walked along meandering transects within or around the graded area (see above.). For sites that cannot be walked, bird surveys should be conducted from many lookout posts, established at key vantage points. The general location of lookout posts should be recorded in the field notebook or drawn onto the aerial photograph or topographic map. Lookout post locations do not need to be staked. Both binoculars and spotting scopes may be used in order to accurately identify and count the birds. Depending upon the size of the open water, more time may be spent viewing the mitigation area from lookout posts than is spent traveling between posts.

Survey Time

Ideally, bird surveys should be conducted in the morning hours when bird activity is often greatest (i.e. sunrise to no later than 11:00 am). Surveys can be completed before 11am if all transects have been walked or all lookout posts have been viewed with no new bird activity observed. For some sites bird surveys may need to be performed in the late afternoon or evening due to traveling constraints or weather. The overall limiting time factor will be the number of budgeted hours for the project.

Data Recording

Bird Species List: Record each bird species observed onto the Bird Survey-Field Data Sheet (or field notebook). Record the bird's common name using the appropriate 4-letter code. The 4-letter code uses the first two letters of the first two word's of the bird's common name or if one name, the first four letters. For example, Mourning Dove is coded as MODO while Mallard is coded as MALL. If an unknown individual is observed, use the 4-letter protocol, but define your

abbreviation at the bottom of the field data sheet. For example, unknown shorebird is UNSB; unknown brown bird is UNBR; unknown warbler is UNWA; and unknown waterfowl is UNWF. For a flyover of a flock of unknown species, use a term that describes the birds' general characteristics and include the approximate flock size in parenthesis; do not fill in the habitat column. For example, a flock of black, medium-sized birds could be coded as UNBB / FO (25).

Bird Density: For each observation record the actual or estimated number of individuals observed per species and per behavior. Totals can be tallied in the office and entered onto the Bird Survey-Field Data Sheet.

Bird Behavior: Bird behavior must be identified by what is known. When a species is observed, the behavior that is immediately exhibited is recorded. Only behaviors that have discreet descriptive terms should be used. The following terms are recommended: breeding pair (BP); foraging (F); flyover (FO); loafing (L), which is defined as sleeping, roosting, or floating with head tucked under wing; and nesting (N). If other behaviors that have a specific descriptive word are observed then it can be used and should later be added to the protocol. Descriptive words or phrases such as "migrating" or "living on site" are unknown behaviors.

Bird Species Habitat Use: When a species is observed, the habitat is also recorded. The following broad habitat categories are used:

- aquatic bed (AB), defined as rooted-floating, floating-leaved, or submergent vegetation.
- marsh (MA), defined as emergent (e.g. cattail, bulrush) vegetation with surface water.
- wet meadow (WM), defined as grasses, sedges, or rushes with little to no surface water.
- scrub-shrub (SS), defined as shrub covered wetland.
- forested (FO), defined as tree covered wetland.
- open water (OW), defined as unvegetated surface water.
- upland (UP), defined as the upland buffer.

Other categories can be used and defined on the data sheet and should later be added to the protocol.

Other Fields

Bird Visit: Each bird survey (i.e. spring, fall, and mid-season) should be completed on separate Bird Survey-Field Data Sheets.

Time: Record the start time and end time on the Bird Survey-Field Data Sheet.

Date: Record the date of the bird survey.

Weather: Record the weather conditions (i.e. temperature, wind, condition).

Notes: Note if a particular individual bird is using a constructed nest box and note the condition of constructed nest box(es). Also record any comments about the site, wildlife, wetland conditions, etc.

GPS MAPPING AND AERIAL PHOTO REFERENCING PROCEDURE

From 2001 through 2006, PBS&J mapped the vegetation community boundaries, photograph points, and other sampling locations in the field using the resource-grade Trimble GEO III GPS (Global Positioning System) unit. The data were collected with a minimum of three positions per feature using Course/Acquisition code. The collected data were then transferred to a personal computer (PC) and differentially corrected to the nearest operating Community Base Station. The corrected data were then exported to ACAD drawings in Montana State Plain Coordinates NAD 83 international feet. The Trimble GEO III GPS unit was also used for some sites in 2007.

The collected and processed Trimble Geo III GPS positions had a 68% accuracy of 7 feet except in isolated areas where accuracy fell to 12 feet. This is within the 1 to 5 meter range listed as the expected accuracy of the mapping grade Trimble GPS.

In 2007 and 2008 sites were mapped using the resource-grade Magellan MobileMapper Office GPS unit. The Magellan GPS unit has a comparable accuracy level to the Trimble Geo III unit.

Each year, MDT photographs each mitigation site from the air. These aerial photographs are not geo-referenced, but serve as a visual aid to map wetland development and vegetation communities, and to show approximate locations for various monitoring activities (i.e. photograph points, transects, or macroinvertebrate sampling). Reference points that are observable on the aerial photo (i.e. road, stream channel, or fence) were also marked with the GPS unit in order to better position the aerial photograph. This positioning did not remove any of the distortion inherent to all photos. All mapped features and community boundaries were reviewed by the wetland biologist, to increase the figure's accuracy.

Any relationship of features located to easement or property lines are not to be construed from these figures. These relationships can only be determined with a survey by a licensed surveyor.

Appendix F

2009 MACROINVERTEBRATE SAMPLING PROTOCOL AND DATA

MDT Wetland Mitigation Monitoring
Little Muddy Creek
Cascade County, Montana

AQUATIC INVERTEBRATE SAMPLING PROTOCOL

Equipment List

- D-frame sampling net with 1 mm mesh.
- 1-liter, wide-mouth, plastic sample jars provided by Rhithron Associates, Inc. (Quart sized, wide-mouthed canning jars can be substituted.)
- 95% ethanol (alternatively isopropyl alcohol).
- Pre-printed sample labels (printed on rite-in-the-rain paper); two labels per sample.
- Pencil.
- Clear packaging tape.
- 3-5 gallon plastic pail.
- Large tea strainer or framed screen.
- Cooler with ice for storing sample.

Site Selection

Select a site that is accessible with hip waders or rubber boots. If the substrate is too soft, place a wide board down to walk on. Choose a site that is representative of the overall condition of the wetland. Annual sampling should occur at the same site within the wetland.

Sampling Procedure

Wetland invertebrates (macroinvertebrates) inhabit the substrate, the water column, the stems and leaves of aquatic vegetation, and the water surface. At the given location, each habitat type is sampled and combined into a single 1-liter sample jar. Pre-cautions are made to minimize disturbing the sample site in order to maximize the number of animals collected.

Fill the pail with approximately 1 gallon of wetland water. Ideally, sample the water column from near-shore outward to a depth of 3 feet. Sample the water column using a long sweep of the net, keeping the net at about half the depth of the water. Sample the water surface with a long sweep of the net. Aquatic vegetation is sampled by pulling the net beneath the water surface, for at least a meter in distance. The substrate is sampled by pulling the net along the bottom, bumping it against the substrate several times as you pull. Be sure to place some muck, mud, and/or vegetation into the jar. After sampling a habitat, rinse the net in the bucket and look for insects, crustaceans, and other aquatic invertebrates. It is not necessary to sample habitats in any specific order, but all habitats, if present, are to be sampled. Habitats can be sampled more than once.

Fill about 1 cup of ethanol into the sample jar. Sieve the contents of the bucket through the straining device and pour or carefully scrape the contents of the strainer into the sample jar. Top off the jar with enough ethanol to cover all the material and leave as little headroom as possible. Alternatively, sampled materials can be lifted out of the net and put directly into the jar. Be sure to include some muck, mud, and/or vegetation into the jar. Each macroinvertebrate sampling site should have only one sampling jar.

Using pencil, complete two labels with the required information: project name, project number, date, collector's name, and habitats sampled. Do not complete the label with ink as it will dissolve in ethanol. For wetlands with at least two macroinvertebrate sampling sites, number the site consecutively followed by the total number of sites (e.g. Sample 2 of 3 sites). Place one label into the jar and seal the jar. Dry the jar off, if necessary, and tape the second label to the outside of the jar.

Photograph each macroinvertebrate sampling site.

Sample Handling/Delivery

In the field, keep sample jars cool by placing in a cooler with a small amount of ice.
Deliver samples to the PBS&J office in Missoula, where they will be inventoried and delivered to Rhithron Associates, Inc.

MDT Mitigated Wetland Monitoring Project: Aquatic Invertebrate Monitoring
Summary 2001 – 2009

Prepared for Post, Buckley, Schuh, and Jernigan (PBS&J)
Prepared by W.Bollman, Rhithron Associates, Inc.

INTRODUCTION

This report summarizes data generated from eight years of mitigated wetland monitoring from sites throughout the State of Montana. A total of 229 invertebrate samples have been collected over the study period. Table 1 lists the currently monitored sites at which aquatic invertebrates were collected in 2009, and summarizes the sampling history of each.

METHODS

Sampling and Sample Processing

Aquatic invertebrate samples were collected at mitigated wetland sites in the summer months of 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, and 2009 by personnel of PBS&J. Sampling procedures were based on the protocols developed by the Montana Department of Environmental Quality (MDEQ) for wetland sampling. Sampling consisted of D-frame net sweeps through emergent vegetation (when present), the water column, and over the water surface, and included disturbing and scraping substrates at each sampled site. These sample components were composited and preserved in ethanol at each wetland site. Samples were delivered to Rhithron Associates, Inc. for processing, taxonomic determinations, and data analysis.

Standard sorting protocols were applied to achieve representative subsamples of a minimum of 100 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm, were used. Grid contents were examined under stereoscopic microscopes using 10x-30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 95% ethanol for subsequent identification. Grid selection, examination, and sorting continued until at least 100 organisms were sorted. A large/rare search was conducted to collect any taxa not found in the subsampling procedure.

Organisms were individually examined using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to the lowest practical taxonomic levels using appropriate published taxonomic references. Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. To obtain accuracy in richness measures, organisms that could not be identified to the target level specified in MDEQ protocols were designated as “not unique” if other specimens from the same group could be taken to target levels. Organisms designated as “unique” were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory. Midges were morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were also archived at the Rhithron laboratory.

Assessment

The method employed to assess these wetlands is based on an index incorporating a battery of 12 bioassessment metrics or attributes (Table 1) tested and recommended by Stribling et al. (1995) in a report to the Montana Department of Health and Environmental Science. In that study, it was determined that some of the metrics were of limited use in some geographic regions, and for some wetland types. Despite that finding, all 12 metrics are used in this evaluation of mitigated wetlands, since detailed geographic information and wetland classifications were unavailable for this report. Scoring criteria for the 12 metrics were developed specifically for this project, since mitigated wetlands were not included in original criteria development.

Scoring criteria for wetland metrics were developed by generally following the tactic used by Stribling et al. (1995). Boxplots were generated using a statistical software package (Statistica™), and distributions, median values, ranges, and quartiles for each metric were examined. For the wetland sites, “good” scores were generally

those that fell above the 75th percentile (for those metrics that decrease in value in response to stress) or below the 25th percentile (for metrics that respond to stress by an increase in value) of all scores. Additional scoring ranges were established by bisecting the range below the 75th percentile for decreasing scores (or above the 25th percentile for increasing scores) into "sub-optimal" and "poor" assessment categories. A score of 5, 3, or 1 was assigned to good, sub-optimal, and poor metric performance, respectively. In this way, metric values were translated into normalized metric scores, and scores for all metrics were summed to produce a total bioassessment score, which is expressed as a percentage of the maximum possible score (60). Total bioassessment scores were classified according to a similar process, using the ranges and distributions of total scores for all sites studied between 2001 and 2007. Data from a total of 167 sites were used to develop criteria.

Six sites in this study supported aquatic fauna characteristic of lotic habitats rather than lentic wetland habitats; these sites were excluded from mitigated wetland scoring criteria development, and were evaluated with a metric battery specific to flowing water habitats. In 2008, the lotic sites were Camp Creek (2 sites), Cloud Ranch stream, Jack Creek – McKee Spring, and Jocko Spring Creek (2 sites). Invertebrate assemblages at these sites were generally characteristic of montane or foothill stream conditions and were assessed using the tested metric battery developed for montane streams of Western Montana (MVFP index: Bollman 1998).

The purpose of constructing an index from biological attributes or metrics is to provide a means of integrating information to facilitate the determination of whether management action is needed. However, the nature of the action needed is not determined solely by the index score or impairment classification, but by consideration of an analysis of the component metrics, the taxonomic composition of the assemblages, and other issues. The diagnostic functions of the metrics and taxonomic data need more study since our understanding of the interrelationships of natural environmental factors and anthropogenic disturbances is tentative. Thus, the bioassessment index used in this report may not be universally applicable to all wetland types, and in particular, to constructed wetlands. Scores and impairment classifications derived from the index may not be valid indications of impairment or non-impairment. In addition, the further interpretive remarks accompanying the raw taxonomic and metric data in this summary are offered cautiously. Year-to-year comparisons depend on an assumption that specific sites were revisited in each year, and that equivalent sampling methods were utilized at each site revisit.

Bioassessment metrics - wetlands

An index based on the performance of 12 metrics was constructed, as described above. Table 2 lists those metrics, describes their calculation and the expected response of each to increased degradation or impairment of the wetland.

In addition to the summed scores of each metric and the associated impairment classification described above, each individual metric informs the bioassessment to some degree. The four richness metrics (Total taxa, POET, Chironomidae taxa, and Crustacea taxa + Mollusca taxa) can be interpreted to express habitat complexity as well as water quality. Complex, diverse habitats consist of variable substrates, emergent vegetation, variable water depths and other factors, and are potential features of long-established stable wetlands with minimal human disturbance. In the study conducted by Stribling et al. (1995), all four richness metrics were found to be significantly associated with water quality parameters including conductance, salinity, and total dissolved solids.

Four composition metrics (%Chironomidae, %Orthocladiinae of Chironomidae, %Crustacea + %Mollusca, and %Amphipoda) measure the relative contributions of certain taxonomic groups that may have significant responses to habitat and/or water quality impacts. For example, amphipods have been demonstrated to increase in abundance in alkaline conditions. Short-lived, relatively mobile taxa such as chironomids dominate ephemeral environments; many are hemoglobin-bearers capable of tolerating de-oxygenated conditions.

Two tolerance metrics (Hilsenhoff Biotic Index [HBI] and %Dominant Taxon) were included in the bioassessment battery. The HBI indicates the overall invertebrate assemblage tolerance to nutrient enrichment, warm water, and/or low dissolved oxygen conditions. The percent abundance of the dominant taxon has been demonstrated to be strongly associated with pH, conductance, salinity, total organic carbon, and total dissolved solids.

Two trophic measures (%Collector-gatherers and %Filterers) may be helpful in expressing functional integrity of the invertebrate assemblage, which can be impacted by poor water quality or habitat degradation. High proportions of filtering organisms suggest nutrient and/or organic enrichment, while abundant collectors suggest more positive functional conditions and well-developed wetland morphology. These organisms graze periphyton growing on stable surfaces such as macrophytes.

Summary metric values and scores for the 2009 samples are given in Tables 4a-4c and 5. Thermal preference of invertebrate assemblages was calculated using Brandt 2001.

Bioassessment metrics – lotic habitats

For sites supporting rheophilic invertebrate assemblages, bioassessment was based on a metric battery and scoring criteria developed for montane regions of Montana (MVFP index: Bollman 1998). The six metrics constituting the bioassessment index used for MVFP sites in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998). They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998). Each of the six metrics and their expected responses to various stressors are described below.

1. Ephemeroptera (mayfly) taxa richness. The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.

2. Plecoptera (stonefly) taxa richness. Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.

3. Trichoptera (caddisfly) taxa richness. Caddisfly taxa richness has been shown to decline when sediment deposition affects habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.

4. Number of sensitive taxa. Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998).

5. Percent filter feeders. Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* spp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.

6. Percent tolerant taxa. Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others.

Table 1. Montana Department of Transportation Mitigated Wetlands Monitoring Project sites: sampling history. Only sites sampled in 2009 are included. An asterisk indicates lotic sites.

Site identifier	2002	2003	2004	2005	2006	2007	2008	2009
Camp Creek MS-1*	+	+	+	+	+	+	+	+
Camp Creek MS-2*					+	+	+	+
Cloud Ranch Pond			+	+	+	+	+	+
Cloud Ranch Stream (Big Timber)*			+			+	+	+
Jack Creek – McKee Spring Creek*					+	+	+	+
Jack Creek – pond			+	+	+	+	+	+
Rock Creek Ranch				+	+	+	+	+
Wagner Marsh				+	+	+	+	+
Alkali Lake 1					+	+	+	+
West Fork of Charley Creek						+	+	+
Little Muddy Creek						+	+	+
Selkirk Ranch						+	+	+
Jocko Spring Creek MS1							+	+
Jocko Spring Creek MS2							+	+
Sportsman's Campground Site #1							+	+
Sportsman's Campground Site #2							+	+
Sportsman's Campground Site #3							+	+
Lonepine #1							+	+
Lonepine #2							+	+

Table 2. Aquatic invertebrate metrics employed for wetland (lentic) invertebrate assemblages in the MDT mitigated wetlands study, 2001 – 2009.

Metric	Metric calculation	Expected response to degradation or impairment
Total taxa	Count of unique taxa identified to lowest recommended taxonomic level.	Decrease
POET	Count of unique Plecoptera, Trichoptera, Ephemeroptera, and Odonata taxa identified to lowest recommended taxonomic level.	Decrease
Chironomidae taxa	Count of unique midge taxa identified to lowest recommended taxonomic level.	Decrease
Crustacea taxa + Mollusca taxa	Count of unique Crustacea taxa and Mollusca taxa identified to lowest recommended taxonomic level.	Decrease
% Chironomidae	Percent abundance of midges in the subsample.	Increase
Orthocladiinae / Chironomidae	Number of individual midges in the sub-family Orthocladiinae / total number of midges in the subsample.	Decrease
%Amphipoda	Percent abundance of amphipods in the subsample.	Increase
%Crustacea + %Mollusca	Percent abundance of crustaceans in the subsample plus percent abundance of molluscs in the subsample.	Increase
HBI	Relative abundance of each taxon multiplied by that taxon's modified Hilsenhoff Biotic Index (tolerance) value. These numbers are summed over all taxa in the subsample.	Increase
%Dominant taxon	Percent abundance of the most abundant taxon in the subsample.	Increase
%Collector-Gatherers	Percent abundance of organisms in the collector-gatherer functional group.	Decrease
%Filterers	Percent abundance of organisms in the filterer functional group.	Increase

RESULTS

(Note: Individual site discussions were removed from this report by PBS&J and are included in the macroinvertebrate sections of individual monitoring reports. Summary tables for lentic (4a – 4c) and lotic (5) sites and project specific taxa listing(s) and metrics report(s) are provided on the following pages.)

Table 4a. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2009 sampling.

METRIC	Cloud Ranch Pond	Jack Creek Pond	Rock Creek Ranch	Wagner Marsh	Alkali Lake	West Fork of Charley Creek	Little Muddy Creek
Total taxa	15	11	20	18	17	7	18
POET	2	0	2	3	1	0	1
Chironomidae taxa	6	3	3	5	10	2	6
Crustacea + Mollusca	0	5	6	7	1	1	6
% Chironomidae	14.47%	66.67%	43.75%	16.07%	61.00%	2.73%	42.40%
Orthocladiinae/Chir	45.45%	20.00%	57.14%	22.22%	52.46%	0.00%	86.79%
%Amphipoda	0.00%	3.33%	0.00%	1.79%	0.00%	91.82%	4.80%
%Crustacea + %Mollusca	0.00%	23.33%	32.14%	34.82%	1.00%	91.82%	34.40%
HBI	6.026666	9	7.045045	7.981652	6	7.90909	7.448
%Dominant taxon	40.79%	53.33%	23.21%	23.21%	30.00%	91.82%	36.00%
%Collector-Gatherers	21.05%	73.33%	61.61%	43.75%	51.00%	91.82%	37.60%
%Filterers	0.00%	0.00%	7.14%	4.46%	0.00%	0.00%	4.80%
Total taxa	3	1	3	3	3	1	3
POET	1	1	1	3	1	1	1
Chironomidae taxa	3	3	3	3	5	1	3
Crustacea + Mollusca	1	3	5	5	1	1	5
% Chironomidae	5	1	1	5	1	5	1
Orthocladiinae/Chir	5	3	5	3	5	1	5
%Amphipoda	5	5	5	5	5	1	3
%Crustacea + %Mollusca	5	5	5	3	5	1	3
HBI	5	1	3	1	5	1	3
%Dominant taxon	3	1	5	5	5	1	3
%Collector-Gatherers	1	3	3	1	3	5	1
%Filterers	3	3	1	3	3	3	3
Total score	**40**	**30**	**40**	**40**	**42**	**22**	**34**
Percent of maximum score	**66.67%**	**50.00%**	**66.67%**	**66.67%**	**70.00%**	**36.67%**	**56.67%**
Impairment classification	**optimal**	**sub-optimal**	**optimal**	**optimal**	**optimal**	**poor**	**sub-optimal**

Table 4b. Metric values and scores for wetland (lentic) sites in the MDT mitigated wetland study – 2009 sampling.

METRIC	Selkirk Ranch	Sportsman's Campground Site #1	Sportsman's Campground Site #2	Sportsman's Campground Site #3	Lonepine #1	Lonepine #2
Total taxa	17	19	11	23	22	19
POET	1	1	0	2	2	3
Chironomidae taxa	6	10	8	11	11	8
Crustacea + Mollusca	6	4	2	4	4	2
% Chironomidae	27.27%	38.46%	90.00%	41.82%	67.83%	25.86%
Orthocladiinae/Chir	43.33%	37.50%	3.33%	23.91%	7.69%	16.67%
%Amphipoda	5.45%	25.96%	2.00%	4.55%	0.00%	0.00%
%Crustacea + %Mollusca	62.73%	51.92%	5.00%	50.00%	6.96%	18.10%
HBI	8.245455	6.942309	6.9	7.345455	7.196427	7.191304
%Dominant taxon	30.00%	24.04%	45.00%	27.27%	51.30%	15.52%
%Collector-Gatherers	57.27%	50.00%	91.00%	83.64%	86.09%	63.79%
%Filterers	3.64%	25.96%	18.00%	29.09%	1.74%	6.03%
Total taxa	3	3	1	5	5	3
POET	1	1	1	1	1	3
Chironomidae taxa	3	5	5	5	5	5
Crustacea + Mollusca	5	3	1	3	3	1
% Chironomidae	3	3	1	1	1	3
Orthocladiinae/Chir	3	3	1	3	1	1
%Amphipoda	3	1	5	3	5	5
%Crustacea + %Mollusca	3	3	5	3	5	5
HBI	1	3	3	3	3	3
%Dominant taxon	5	5	3	5	1	5
%Collector-Gatherers	3	3	5	5	5	3
%Filterers	3	1	1	1	3	1
Total score	**36**	**34**	**32**	**38**	**38**	**38**
Percent of maximum score	**60.00%**	**56.67%**	**53.33%**	**63.33%**	**63.33%**	**63.33%**
Impairment classification	**sub-optimal**	**sub-optimal**	**sub-optimal**	**sub-optimal**	**sub-optimal**	**sub-optimal**

Table 5. Metric values and scores for stream (lotic) sites in the MDT mitigated wetland study – 2009 sampling.

METRIC	Camp Creek MS-1	Camp Creek MS-2	Cloud Ranch Stream	Jack Creek McKee	Jocko Spring Creek MS-1	Jocko Spring Creek MS-2
E Richness	2	4	1	1	2	1
P Richness	1	0	0	0	0	0
T Richness	2	4	4	1	3	2
Pollution Sensitive Richness	1	1	0	0	1	0
Filterer Percent	11.88%	22.02%	18.18%	25.23%	27.36%	10.91%
Pollution Tolerant Percent	13.86%	12.84%	15.15%	8.41%	12.26%	32.73%
E Richness	1	2	0	0	1	0
P Richness	1	0	0	0	0	0
T Richness	1	2	2	0	2	1
Pollution Sensitive Richness	1	1	0	0	1	0
Filterer Percent	1	1	1	0	0	1
Pollution Tolerant Percent	1	1	1	2	1	1
Total score	**6**	**7**	**4**	**2**	**5**	**3**
Percent of maximum score	**33.33%**	**38.89%**	**22.22%**	**11.11%**	**27.78%**	**16.67%**
Impairment classification	**moderate**	**moderate**	**moderate**	**severe**	**moderate**	**severe**

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Bollman, W. 1998. Montana Valleys and Foothill Prairies Ecoregion. Master's Thesis. (M.S.) University of Montana. Missoula, Montana.

Brandt, D. 2001. Temperature Preferences and Tolerances for 137 Common Idaho Macroinvertebrate Taxa. Report to the Idaho Department of Environmental Quality, Coeur d' Alene, Idaho.

Caton, L. W. 1991. Improving subsampling methods for the EPA's "Rapid Bioassessment" benthic protocols. Bulletin of the North American Benthological Society. 8(3): 317-319.

Stribling, J.B., J. Lathrop-Davis, M.T. Barbour, J.S. White, and E.W. Leppo. 1995. Evaluation of environmental indicators for the wetlands of Montana: the multimetric approach using benthic macroinvertebrates. Report to the Montana Department of Health and Environmental Science. Helena, Montana.

Taxa Listing

Project ID: MDT09PBSJ
RAI No.: MDT09PBSJ019

RAI No.: MDT09PBSJ019 **Sta. Name:** Little Muddy Creek
Client ID:
Date Coll.: 8/3/2009 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Acari	1	0.80%	Yes	Unknown		5	PR
Cladocera	6	4.80%	Yes	Unknown		8	CF
Copepoda	2	1.60%	Yes	Unknown		8	CG
Ostracoda	27	21.60%	Yes	Unknown		8	CG
Hyalellidae							
Hyalella sp.	6	4.80%	Yes	Unknown		8	CG
Lymnaeidae							
Stagnicola sp.	1	0.80%	Yes	Unknown		6	SC
Planorbidae							
Planorbidae	1	0.80%	Yes	Immature		6	SC
Odonata							
Coenagrionidae							
Coenagrionidae	1	0.80%	Yes	Larva		7	PR
Heteroptera							
Corixidae							
Cenocorixa sp.	2	1.60%	Yes	Adult		8	PR
Corixidae	9	7.20%	No	Adult	Damaged	10	PH
Coleoptera							
Dytiscidae							
Dytiscidae	3	2.40%	Yes	Larva		5	PR
Liodessus sp.	1	0.80%	Yes	Adult		5	PR
Diptera							
Ceratopogonidae							
Ceratopogonidae	4	3.20%	No	Pupa		6	PR
Ceratopogoninae	8	6.40%	Yes	Larva		6	PR
Chironomidae							
Chironomidae							
Acricotopus sp.	1	0.80%	Yes	Larva		10	CG
Chironomus sp.	2	1.60%	Yes	Larva		10	CG
Cricotopus (Isocladius) sp.	45	36.00%	Yes	Larva		7	SH
Cryptochironomus sp.	1	0.80%	Yes	Larva		8	PR
Cryptotendipes sp.	3	2.40%	Yes	Larva		6	CG
Glyptotendipes sp.	1	0.80%	Yes	Larva		10	SH
Sample Count	**125**						

Metrics Report

Project ID: MDT09PBSJ
RAI No.: MDT09PBSJ019
Sta. Name: Little Muddy Creek
Client ID:
STORET ID:
Coll. Date: 8/3/2009

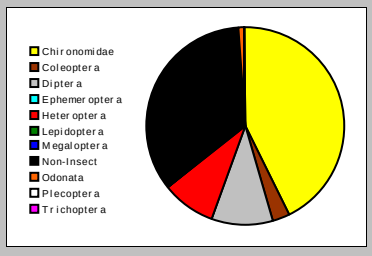
Abundance Measures

Sample Count: 125
Sample Abundance: 750.00 16.67% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	7	44	35.20%
Odonata	1	1	0.80%
Ephemeroptera			
Plecoptera			
Heteroptera	1	11	8.80%
Megaloptera			
Trichoptera			
Lepidoptera			
Coleoptera	2	4	3.20%
Diptera	1	12	9.60%
Chironomidae	6	53	42.40%

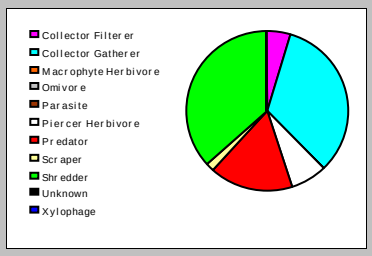


Dominant Taxa

Category	A	PRA
Cricotopus (Isocladius)	45	36.00%
Ostracoda	27	21.60%
Corixidae	9	7.20%
Ceratopogoninae	8	6.40%
Hyalella	6	4.80%
Cladocera	6	4.80%
Ceratopogonidae	4	3.20%
Dytiscidae	3	2.40%
Cryptotendipes	3	2.40%
Copepoda	2	1.60%
Chironomus	2	1.60%
Cenocorixa	2	1.60%
Planorbidae	1	0.80%
Glyptotendipes	1	0.80%
Cryptochironomus	1	0.80%

Functional Composition

Category	R	A	PRA
Predator	7	21	16.80%
Parasite			
Collector Gatherer	6	41	32.80%
Collector Filterer	1	6	4.80%
Macrophyte Herbivore			
Piercer Herbivore	0	9	7.20%
Xylophage			
Scraper	2	2	1.60%
Shredder	2	46	36.80%
Omivore			
Unknown			



Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	18	1	2		0
Non-Insect Percent	35.20%				
E Richness	0	1		0	
P Richness	0	1		0	
T Richness	0	1		0	
EPT Richness	0		0		0
EPT Percent	0.00%		0		0
Oligochaeta+Hirudinea Percent					
Baetidae/Ephemeroptera	0.000				
Hydropsychidae/Trichoptera	0.000				
Dominance					
Dominant Taxon Percent	36.00%		2		1
Dominant Taxa (2) Percent	57.60%				
Dominant Taxa (3) Percent	64.80%	3			
Dominant Taxa (10) Percent	90.40%				
Diversity					
Shannon H (loge)	1.958				
Shannon H (log2)	2.825		2		
Margalef D	3.603				
Simpson D	0.227				
Evenness	0.094				
Function					
Predator Richness	7		3		
Predator Percent	16.80%	3			
Filterer Richness	1				
Filterer Percent	4.80%			3	
Collector Percent	37.60%		3		3
Scraper+Shredder Percent	38.40%		3		1
Scraper/Filterer	0.333				
Scraper/Scraper+Filterer	0.250				
Habit					
Burrower Richness	3				
Burrower Percent	8.80%				
Swimmer Richness	2				
Swimmer Percent	9.60%				
Clinger Richness	1	1			
Clinger Percent	36.00%				
Characteristics					
Cold Stenotherm Richness	0				
Cold Stenotherm Percent	0.00%				
Hemoglobin Bearer Richness	5				
Hemoglobin Bearer Percent	6.40%				
Air Breather Richness	2				
Air Breather Percent	3.20%				
Voltinism					
Univoltine Richness	6				
Semivoltine Richness	2	1			
Multivoltine Percent	71.20%		1		
Tolerance					
Sediment Tolerant Richness	2				
Sediment Tolerant Percent	1.60%				
Sediment Sensitive Richness	0				
Sediment Sensitive Percent	0.00%				
Metals Tolerance Index	4.405				
Pollution Sensitive Richness	0	1		0	
Pollution Tolerant Percent	9.60%	5		2	
Hilsenhoff Biotic Index	7.448		0		0
Intolerant Percent	0.00%				
Supertolerant Percent	45.60%				
CTQa	104.400				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	18	36.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	16	53.33%	Moderate
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	5	27.78%	Moderate
MTM	Montana DEQ Mountains (Bukantis 1998)	5	23.81%	Moderate

